The Electrical World.

VOL. XXXII. NEW YORK, OCTOBER 29, 1898. No. 18.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

9 Murray Street, New York.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York.

New England Office, 620 Atlantic Ave., Boston.

Western Office, 936 Monadnock Block, Chicago.

Philadelphia Office, 929 Chestnut Street.

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SUBMARINE CONDUITS.

From the early days of the telegraph industry it has been customary to carry electrical lines under rivers by means of iron-armored cables generally also lead-covered. Since the development in this country of draw-in conduit systems for subterranean work, the advantages of this plan have become more and more apparent for river crossings not too long for the drawing in of cables, that is, less than 800 or 1000 feet in length, and during the last two years several such conduits have been put in. A description of two such installations of conduits lately constructed in Boston may be found on another page of this issue. The advantages of this system over cables simply sunk into the river bottom are numerous. For telephone and telegraph service armored cables are rarely made in sizes larger than those carrying fifteen pairs of conductors, and the sheathing and armoring of six such cables, as compared with the lead covering of one one-hundred-pair cable, is very expensive, so that when several hundred pairs cross at one point the saving is a large one. Outside of the question of cost the conduit gives a solid structure deep enough in the mud to be sheltered from anchors, etc., and sufficiently solid to resist almost any probable mechanical disturbance. If not dependent for life on metal the depreciation of that part of it below low-water line is extremely small.

Of the two conduits described on another page one contains iron-pipe ducts protected carefully against corrosion on the outer sides and intended to be kept dry inside, or, if this cannot be accomplished, to be filled with a heavy oil. The other abandons the use of iron altogether and depends on wooden ducts which will not corrode and give a smooth surface for drawing, the only criticism against them not applying to the other being that ice is more likely to affect the cables and perhaps crush and split the lead sheathing, the iron in the other case being intended to prevent this. A combination of the merits of the two might be obtained by using a wooden duct with a strong iron lining at and near the water line where only it is affected by ice and where the iron after corrosion may be readily renewed.

SPECIAL TRACKWORK FOR ELECTRIC RAILWAYS.

Perhaps the greatest source of trouble and rapid depreciation of an electric railway equipment has been the pounding of the rolling stock on uneven rail surfaces. The conditions of street traffic are such as to require a rigid roadbed, which acts as an anvil, giving at every inequality in the surface a blow that not only increases the inequality but flattens the wheel tread, sharpens the flange, destroys the gear teeth, distorts the journals, loosens the truck bolts, disintegrates the insulation, causes sparking at the commutator, sags the side frames, rattles the windows, makes the riding uncomfortable and disagreeable, necessitates the slowing down of the cars, and thus lengthens the schedule, and last, but not least, reduces dividends.

Now that the joint problem bids fair to be satisfactorily solved, one other source of this pounding which, though not as frequent, is more severe, needs attention. This source is the switches and frogs of turnouts and crossings. In the evolution of the heavy girder rail from the old strap rail of the horse car lines, the surface of the special work has remained as it was, and the smooth-riding fittings of steam railroad practice have not been imitated. It seems to be the general opinion that the special conditions of

mud, slush, etc., prohibit the use of such fittings, although the practice of cable roads in the use of elaborate fixtures below the surface should prove the contrary. The old tongue switch on one rail, with the permissive mate on the other, take the place of the finely pointed double split switch of steam railroad practice. An attempt is made to transfer the weight on the wheel from the tread and head of the rail to the flange and groove in passing such mates and frogs, but with what success the passenger can readily tell. The pounding is so severe that extra hard pieces of steel are now inset at these points, with even worse results to the rolling equipment.

Underground switch-operating rods connected to levers are now quite commonly used, and there is no reason why the switch cannot be made positive on both rails as well as one. Spring switches are also often used, in spite of the ice and mud, and spring rail and frogs might be built on the same general designs that would be of great value in rarely used turnouts and crossings on heavily traveled lines. With the heavy cars, high speed and short headway of some of the larger lines any improvements in this respect would mean a great gain, and if the desired result could be accomplished in no other way it might almost pay to go to the extreme of constructing a subterranean chamber and supporting all special work on springs to avoid the severe pounding and banging of the cars at these points.

ADJUSTING FOR MINIMUM CURRENT.

In the running of synchronous motors and rotary converters on alternating-current combined light and power systems, a most crude and primitive practice prevails as to the adjustment of the field magnetization. As is well known, any synchronous machine will run with an extremely wide range of current in the shunt field coils, in fact, it is often impossible to break down the machine by any change whatever; but slight changes do have a great effect on the wattless currents introduced into the system, and these wattless currents have a most disturbing effect on the regulation, which is often fatal to the use of incandescent lights on the same mains. The adjustment is generally made for minimum alternating current, since with minimum current there must be unity power factor—that is, no wattless currents.

In principle this would be commendable if by any means the point of minimum current could be determined with any degree of accuracy. The combination of the minimum or energy currents with the wattless currents being a vectorial one, a very slight variation from the minimum means a heavy introduction of lagging or leading currents; for example, an increase above the minimum of 5 per cent. means either a lagging or a leading current with a magnitude over one-third of that of the total energy current itself. In one case this lagging current causes an inductive drop of voltage in the dynamos, lines and transformers generally much greater than the ohmic drop; in the other case it causes an inductive rise, which may give a voltage at the motor end of the system greater than that generated by the dynamo. This close adjustment of the ammeter indication to an unknown minimum must be obtained with often a variable load, which keeps the needle swinging, and almost invariably with a hunting or beating tendency of the synchronous machine caused by the slight speed variations of the generator during the rotation, which precludes absolutely anything more than a guess at the proper position for a minimum. A better method, although one even more indirect, would be to adjust the rotary field until its effect on the line-drop is such as to give a proper voltage, but undoubtedly phase-indicating apparatus will be designed which will give accurate indications of the conditions wanted. In this respect the induction motor has an advantage over the synchronous motor, in that its wattless currents, although lagging, are always lagging, and do not vary with the whim of the machine attendant or the beating of the generators.

GOVERNING THE SPEED OF ALTERNATING GENERATORS.

The maintenance of close regulation on alternating-current circuits is a much more difficult matter than on direct-current systems, since in the latter case the dynamos may be and generally are compounded not only to make up by the increased field strength for the drop in speed and the internal fall of voltage on increased load, but may be over-compounded to cover also the line drop. With alternating-current machines of the sizes now coming into use the compound winding is impracticable, and users of such machines are becoming more and more insistent on a close voltage regulation that gives the manufacturing designers no little trouble. Even with a 5 per cent. regulation between no load and full load, non-inductive, the drop at the lamps in case of a change of load is considerable. With a 2 per cent. drop in speed, 5 per cent. drop in the generator, a few more per cent. in the lines, transformers and secondaries, the amount to be made up by a readjustment of the field rheostat is large, but with the increasing use of alternating-current motors the problem is rendered more difficult by the inductive drop, which may double or more than double the ohmic drop in machines, lines and transformers. This load being a fluctuating one, especially with such machines as elevator motors, calls for some cure more prompt than the manipulation of the rheostat by the switchboard attendant.

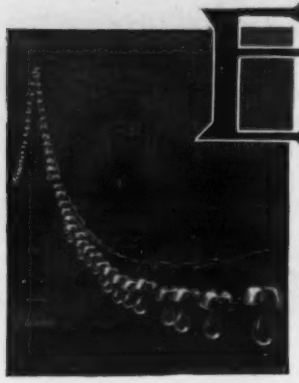
A closer regulation than 5 per cent. even on non-inductive load is a difficult thing to get on alternators, as even this requires a carefully distributed winding, which means an added expense for insulation, and a large ratio of field to armature ampere-turns, which means a machine much more expensive and with much greater iron losses for a given output than one in which the rated load is determined only by the heating limit.

The best place for the solution of the regulation difficulty is in the engine governor, if it can be there effected. It has been customary to consider that the ultimate perfection of the governor mechanism is attained when the governor gives as high a speed with full load as with no load, but there is apparently no insuperable reason why a governor should not be designed that would give a speed higher with increased load and sufficiently so to overcome all other drops, even with a cheaply built generator. Relay governors are now successfully applied to large steam engines, and the relay governor is readily capable of differential attachments which shall bring into the determination of the speed any desired influence. A combination of a relay governor with weights so arranged as to give also the inertia effect and a mechanism designed to influence the speed by the position of the valve mechanism itself, so as to give a rise of speed between no load and full load of say 15 per cent., would give a very nicely compounded alternator. If the governor were influenced electrically by the output of the machine it might be so arranged as to give a rise on inductive load greater than on non-inductive loads and so eliminate the increased drop due to inductance, but this is perhaps too much of a refinement for serious consideration at the present time. The paralleling of alternators so governed would be undoubtedly a problem, but not an inherently insoluble one.

Long-Distance Telephony on the Pacific Coast.

The long-distance telephone line between San Francisco, Cal., and Portland, Ore., was completed on October 13. Through lines to Tacoma and Spokane by way of Walla Walla were completed the previous week. All of these lines are of 435-pound copper wire. Speech has been carried on between San Francisco and Spokane, a distance of 1300 miles as the wires run. On October 16 the first public test and official opening was made of the line between San Francisco and Portland, with the usual musical selections, and the next day a public exhibition was given, with twenty receivers in the Exhibition Building at the Portland end of the line, the mayors of the two cities exchanging compliments and congratulations.

Electric Lighting in the Chicago Peace Jubilee.



ELECTRICITY played a shining part in the national peace jubilee at Chicago during the week beginning October 16. Of the decorations which the city put on for the occasion incandescent lights formed the most important and striking feature.

By day the hundreds of miles of bunting spread over the buildings and fluttering in the streets considerably outdid the rows and festoons and pieces formed by the lamps, though even then the continued foggy weather gave a chance for many of the merchants to burn their lights through the daylight hours. But at night-time, when grimy Chicago was transformed into a bower of fairyland, the electric lamp was supreme, as may be imagined on reference to the illustrations on page 441.

Fifty thousand extra incandescent lamps, at the lowest estimate, were burned in the streets of Chicago during the peace jubilee. They made the nights in the downtown districts brighter than the foggy days. A large number of these lights, distributed evenly throughout the business centre, were put up by the jubilee committee. The rest were installed by the business houses, office buildings and individuals. Together they made Chicago, already reputed to be second only to Paris in the brilliancy of its night displays, take rank for a few days as the most gorgeously illuminated city in the world.

The lighting and decoration scheme undertaken by the jubilee committee was a novelty. So far as known to the managers, nothing like it had ever hitherto been attempted, with the exception of the recent Queen's Jubilee in London, where a conspicuous failure was made. The plan decided upon was the startling idea of making for the downtown districts a roof of flags by day and of light by night. The jubilee committee decided to make its roof of flags and lights by stringing rows of both at regular intervals across the streets. The flags were hung on stout ropes, six to ten on each. The lights were swung in graceful festoons from above the centre of the roadways to the buildings on either side. They formed at night the drooping curves of a tent roof, and by day harmonized well with the straighter lines of the bunting canopy. The entire downtown district, with the exception of small portions of the cross streets, was roofed in this manner. Over three miles of streets were decorated, and upward of 10,000 16-cp incandescent lights employed. The work was turned over entirely to the Chicago Edison Company, with directions to install the lamps and run them during jubilee week. Under the supervision of Mr. J. H. Goehst, superintendent of construction, and Assistant Superintendent H. E. Niesz the work was completed in the marvelously short time of two weeks after the signing of the contract. Over 100 men were employed on the task. Taking into consideration the extra construction done on the arches, the Chicago Edison Company surely established a record for rapid work.

After the general form of the illumination was decided upon by the jubilee committee all wiring details were left to the Edison Company. With a rush job of such magnitude it was evident that ordinary methods had to be modified to a considerable extent. The requisite number of waterproof sockets or small street hoods of any kind could not be obtained in a hurry, and special devices had to be employed instead. After a day spent in experimenting, the following form of construction, used throughout the work, was followed:

Small cups 4½ inches across and 2 inches deep, made of tinned sheet iron of the variety commonly known as "tin," were made specially in large quantities by a big hardware firm. A hole was punched in the bottom of each cup. Ordinary keyless sockets of the standard Edison type were fitted each with two pieces of rubber-covered wire about 8 inches long. Through the holes punched in the cups the wires were drawn, pulling the sockets tight up against the bottoms. A small amount of tape, compound and waterproof paint on the outside finished the job, making the cups into serviceable street hoods, which answered equally well for reflectors. These were turned out at the rate of several thousand a day. They cost to make about 2 or 3 cents apiece, and in many cases were retailed to merchants who wanted to decorate with strings of lights at 18 cents apiece. When their present period of usefulness is over the sockets will be taken back again by the Edison Company.

Each festoon was supported above the centre of the street by an insulator hung from two strands of No. 4 B. & S. galvanized iron wire, stretched from building to building. One strand would ordinarily have been sufficient, but Mr. Goehst elected to take no chances of breakages. The festoons themselves were each composed of two strands of No. 6 B. & S. rubber-covered wire, on which the socket wires were spliced at intervals of a few inches. All the construction was made with high-grade rubber-covered wire of the several varieties which the company had on hand or could secure in a hurry. In the London jubilee, where the lighting failed just when most needed, ordinary weatherproof wire was used. The result, after the first heavy rain, was a succession of grounds that ruined the display. Wishing to avoid this trouble, Mr. Goehst insisted on the use of high-grade, rubber-covered wire everywhere, and the outcome fully justified his action.

From 80 to 120 lights, according to the width of the street, were hung on each festoon. Four festoons were put up in each block. Forty-five feet was the average height above the street, although the arches and other decorations at times made variations necessary. Standard 113-volt 16-cp uncolored Edison lamps were used. Every two festoons were put on a small knife switch, which was placed in a waterproof box on the front of the building near the pavement. Taps were made on the street mains of the Edison Company, and not in any case on the building wires. The lights were equally balanced on both sides of the three-wire direct-current system. As some of the runs were long and had a number of lights on them, wire as large as No. 0000 B. & S. was used. Altogether about 20 miles of wire was installed, varying in size from No. 0000 to 14 B. & S.

A neat scheme was adopted in many cases to hold the ends of the festoon wires without damaging the woodwork of the buildings. As over 200 permissions were obtained for the use of windows, assurances had to be given that the wood work would not be injured and that the windows would be left shut. So pieces of 4 by 4 pine scantlings were sawed, of lengths a little greater than the widths of the windows. The scantlings were wrapped with cloths, so as not to scratch even a varnished surface, and the ends of the festoon wires were made fast to them. The weight of the festoons was sufficient to hold these pieces of 4 by 4 in place on the inside of the windows, while the sashes could be closed, except for a small crack at the bottom. This scheme was found perfectly satisfactory where great care had to be used. In other places ordinary porcelain insulators and cleats were employed.

The entire cost of the festooning work is estimated at about $20,000. The Edison Company has agreed to take back the material employed, so that the final expense is not yet known. The city waived its usual inspection fee of 10 cents a light, helping to materially reduce the cost to the jubilee committee. Throughout the work there was not a workman or citizen hurt, and not a mishap of any kind. Although the lights have gone through a week of wind and rain storms so severe that five ornamental arches were destroyed and much of the decorations ruined, yet no trouble of any consequence has been reported. This fact is unquestionably due to the use of high-grade rubber-covered wire and the best of wiring methods.

The lights were turned on every evening at 6:30 o'clock, and extinguished at 11:30 o'clock. Patrolmen did the work, walking from switchbox to switchbox, until all the festoons were reached. The system of decorative light took about 2500 amperes at 220 volts, supplied by the Edison central station. So pleased are the merchants and business men with the festoon lights that a movement was put on foot to continue the nightly illuminations of the city for thirty days more, and the project will doubtless be carried out before this article is read. In fact, there is a strong possibility that some form of permanent lighting by festoons will be kept by the State street merchants.

Next to the festoon lighting the electrical feature of the peace jubilee was the municipal arch, donated to the city by the Western Electric Company, the General Electric Company and the Chicago Edison Company. This structure was built at the corner of La Salle and Washington Streets, near the City Hall. By day it proved to be the best designed and most handsomely decorated of the whole sixteen arches built for the jubilee, while at night its splendor was worth going miles to see.

The municipal arch was designed by John E. Youngberg, an architect of Chicago. Its principal parts were made in various carpenter and paint shops of the city. The entire structure was erected by the Chicago Edison Company, which also did the electric wiring on it. Seven days and nights were required for the work. The arch is 45 feet high and 50 feet wide. It is designed in pure classic style, painted ivory-white and decorated with appropriate portraits and inscriptions. The principal lines of the structure are picked out by uncolored 16-cp lamps, which, in connection with the white color of the arch, make a most beautiful night effect.

The wiring of the municipal arch was pronounced by President Samuel Insull, of the Chicago Edison Company, to be one of the most perfect pieces of work he ever saw. It was done entirely on the hollow inside of the structure. The lights are 1200 in number, set in porcelain wall sockets arranged 15 inches apart on strips of wood, which last were fastened to the arch in 8, 10 and 12 foot lengths. The entire 1200 lights were put in place, wired up and connected in twenty-four hours. Simplex wire was used, donated for the purpose by Mr. H. R. Hixson. The arch is connected with the city hall plant, which furnishes the current, by a 300-foot overhead line, consisting of three No. 0000 B. & S. cables. All the lights are on one 1000-ampere knife switch in the city hall engine room.

The street railway companies of the city decorated for the jubilee with flags and colored lights. Several thousand 16-cp lamps were colored red and blue with collodion for them by the Chicago Edison Company. These, with a proportionate number of clear lamps, were put in the electric cars in place of the regular bulbs. The effect was pretty, but rather dim for good street-car illumination. After the jubilee these colored lamps were dipped in wood alcohol at the expense of a few dollars, and cleaned off for ordinary use.

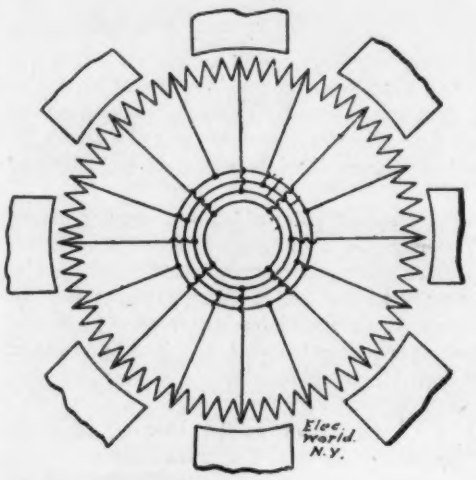
The private lighting displays brought out for the jubilee were many and varied. They took the form principally of signs, shields and strings of lights festooning the fronts of buildings. The great retail merchants of State Street led in this illumination, using thousands of incandescent and many arc lights along the thoroughfare. The newspaper offices and the theatres well seconded their efforts.

Taken all together, the cost of the lighting for the peace jubilee is estimated to be between $30,000 and $40,000. This sum is by far the greatest single item spent by the city in its rejoicing In this respect the celebration just closed differs from all preceding affairs of the kind. It is significant of the progress of the age that the most important part played in an affair of this nature was taken by electricity.

Balancing the Distribution of Current in Parallel-Wound Armatures.

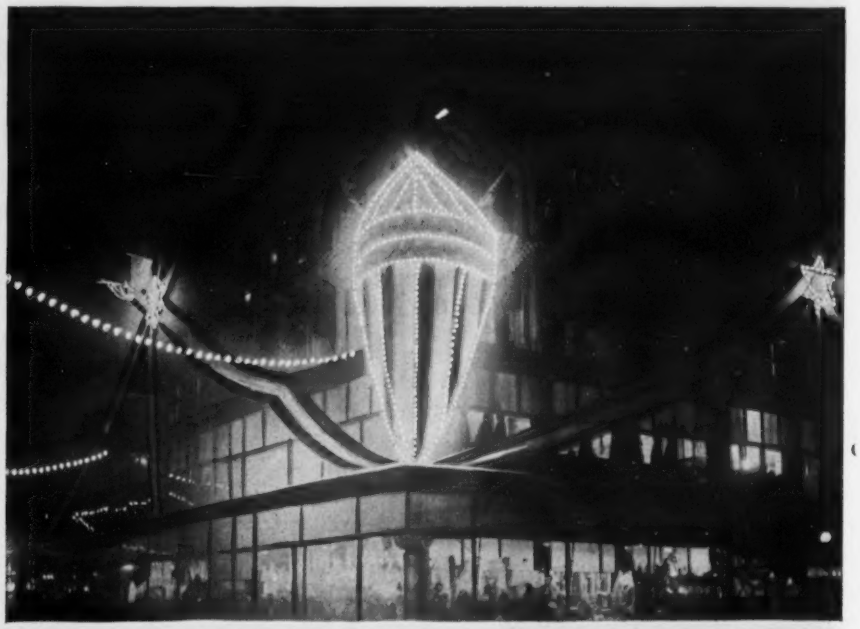
In the armatures of multipolar direct-current dynamos the circuits of which are of the parallel or lap-wound type there is obviously an opportunity for the current generated to be unequally distributed between the windings under various poles. If, for example, one pole, for any reason, is somewhat stronger than the others, giving a higher electromotive force between the adjacent brushholders, each of which is connected directly with all other brushholders of the same polarity, thus throwing the windings under all the poles in parallel with each other, the winding with the higher electromotive force will generate more than its share of the total current. As these local circuits are of extremely low resistance a very slight difference in the electromotive forces will not only unbalance the distribution but even tend to make those of higher pressure force current back through those of lower pressure, thus causing a continual $C^2 R$ loss even when there is no load on the external circuit. While the reaction of such increased current tends to crowd into one horn the lines of force issuing from the pole, and hence to cut down the excess electromotive force, thus equalizing matters to a certain extent, which equalization is obviously aided if the brushes are given any considerable lead, yet, if one pole happens to be low in electromotive force in a machine with a large number of poles the generation of the current backed under it will be more or less equally divided between all the other sections; thus, the reaction on the seven, nine, eleven or more poles generating may be comparatively small, but the current forced back under the one weak pole will so crowd the flux that the pole will be still further weakened, the action becoming cumulative, rendering this part of the winding practically a short circuit on all the other sections. The initial inequality in flux may be due to any one of several causes—eccentricity of the armature, faults in the castings, poor joints in a bolted-up laminated field, inequalities or partial short circuits in the field winding, differences in the adjustment of the lead of the brushes, etc. An extremely simple and ingenious method of overcoming this difficulty is that described by Mr. B. G. Lamme in United States patent No. 573,009, issued December 15, 1896.

As is well known, two or more synchronous alternating-current machines, when run in multiple with each other, mutually adjust each other's field excitation to the same voltage output. Two such machines must maintain synchronism with each other or become mutually short-circuited, and, if the current in the field windings of one is much greater than that of the other, the tendency is for the one with the greater magnetization to generate current and deliver it to the other, driving it as a motor. The other, however, cannot speed up, and the electrical conditions are balanced by an interchange of wattless currents, the reaction of which weakens the field flux of the more strongly excited machine and strengthens that of the more weakly excited machine, until the two, if directly connected together, deliver the same terminal voltage. The windings of any direct-current generator are the seat of alternating electromotive forces, and if provided with collecting rings, such as those of a rotary converter, will give or take alternating currents. The windings passing at any instant under the various poles of a multipolar generator may be considered as alternating-current armatures, which by internally cross-connecting points situated at an angular distance of two-pole angles, and hence of normally the same potential, may be thrown in multiple with each other and be made thereby to automatically balance the field flux of their respective poles, just as do the armatures of independent alternating-current generators in parallel. This is very simply accomplished in large multipolar generators made by the Westinghouse Company by several rings, which may be seen under the leads to the commutator, tapped off to the several points of equal potential. If two such rings are used the balancing effect is the same as would be exerted between a group of single-phase alternators, the wattless current flowing exerting an intermittent or pulsating reactive effect on the poles. By putting in three rings or more the effect may be rendered more steady and similar to that in multiphase machinery.



Cross Connections of Armature Winding.

The same principle may be applied in other ways to direct-current machines. For example, if two compound-wound generators, the armatures of which are subject to the same number of reversals per second, be connected together by collector rings and leads, the field magnets of the two will be rendered always of the same strength even were there no equalizer bus between the series winding and the armature, and the direct-current output would therefore be equally divided. Even were the energy input delivered by their respective driving engines to vary, the direct-current power output would be unaffected, the generator whose engine was doing the heavier work delivering a part of it through the alternating-current circuits to the other machine, which would act as a rotary by transforming to direct current and equalizing the output to the direct-current lines.

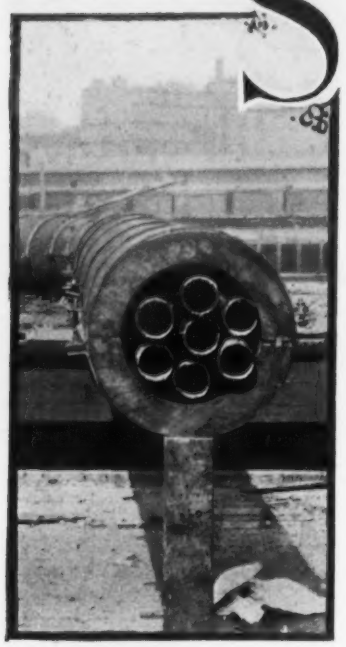


THE ADAMS STREET EDISON STATION.
THE ARCH PRESENTED BY THE WESTERN ELECTRIC COMPANY, THE CHICAGO EDISON COMPANY, AND THE GENERAL ELECTRIC COMPANY.

MANDEL BROTHERS' SHIELD AT NIGHT.
ANOTHER VIEW OF THE MUNICIPAL ARCH.
STATE STREET AT NIGHT.

Some Electric Lighting Effects at the Chicago Peace Jubilee.

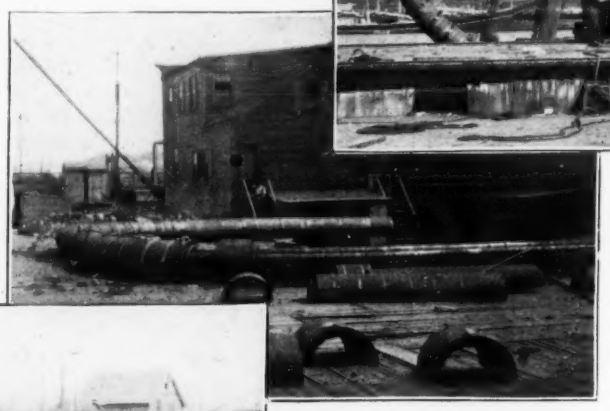
Two Draw-In Conduits Under Boston Rivers.



SUBMARINE conduits suited for drawing in electric lighting, traction, telegraph and telephone cables under narrow rivers are rapidly being accepted as a great improvement over simple armored cables lowered into the stream. But very few such conduits have been constructed in this country up to date, and these differ widely from each other; descriptions of two in New York city have previously appeared in these columns,* and the details of two lately built in Boston are given below.

The one illustrated by several views on this page was constructed by the Union Telegraph & Telephone Company under the Charles River, between Boston and Charlestown, beside the Warren bridge. It was built under the direction of Mr. G. H. Dresser, superintendent of the engineering department, to whom thanks are due for the following details and the accompanying illustrations. The conduit, as shown in cross-section in the initial letter, consists fundamentally of seven wrought iron pipes 4 inches in internal diameter and ¼ inch thick, with tight screw couplings, each pipe being covered to prevent corrosion with alternate layers of Bermuda asphalt and cheesecloth to a depth of three-sixteenths of an inch. The seven pipes are maintained in a proper relative position by wooden diaphragms from 2 to 3 feet apart, 16 inches in external diameter and about 4 inches thick, with holes for the pipes and split into four pieces to allow assembling.

The whole is enclosed in a wooden shell with a thickness of 4 inches and an external diameter of 24 inches, the shell being a regular wooden water pipe made by the Michigan Pipe Company, and sawed lengthwise into two sections, which are grooved and spiked together.

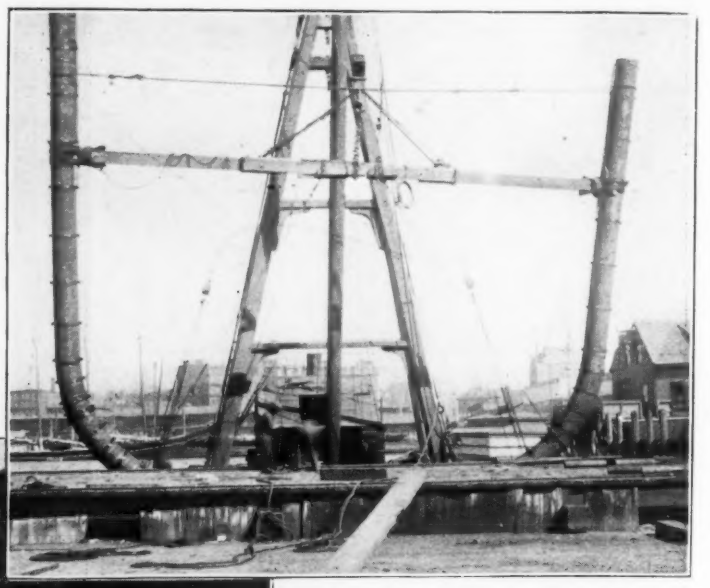


Views of Union Tel. and Tel. Conduit Under Construction.

These sections vary in length from 1½ feet on the curves to 6 feet on the straight runs, and have joints, shown in the accompanying illustrations. All the wood was carefully creosoted before use. The half sections are bound together and around the diaphragms by bands or hoops of ⅜-inch by 2-inch strap iron set up with bolts and nuts. These iron parts will have a short life compared with the intended life of the conduit, but when imbedded firmly in the clay the latter will be properly held together without the hoops. The conduit is in the form of a large U or inverted siphon, with about 48 feet between risers and a length of about 126 feet over all. It was assembled on the draw pier, and, with a heavy beam across the upper end of the U and many stays and ties, was lifted onto a lighter, as shown in one of the illustrations, and lowered into the stream. A trench about 5½ feet deep had previously been dredged in the clay and rock bottom, the rocks being removed by divers. Into this trench the U was sunk until the upper surface of the horizontal section was 4 feet below the level of the bottom of the channel and the trench was then filled flush. It was sunk during the month of September, 1898, being the first submarine conduit in Boston.

Lead-covered cables have been drawn into the ducts, and it is the intention to keep their interior dry. If moisture cannot be kept out, they will be filled with a heavy oil to prevent corrosion. Two similar conduits are to be put in by the same company, one under the Fort Point Channel and the other under the Mystic River.

The other conduit illustrated by the reproductions on the following page is a much larger one, and of a radically new type of construction. It belongs to the Boston Electric Light Company,

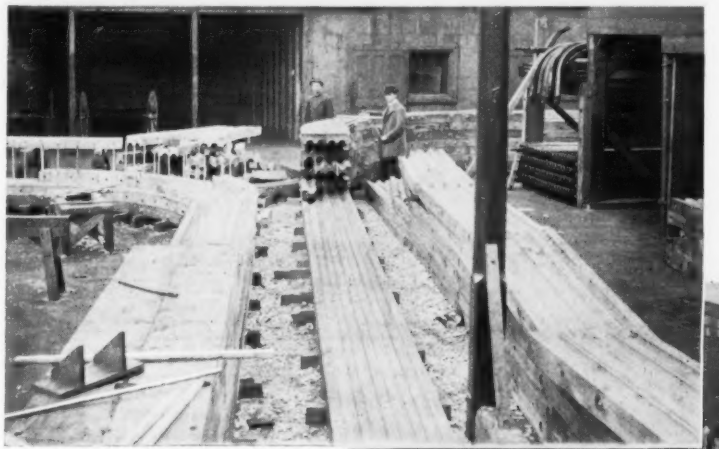


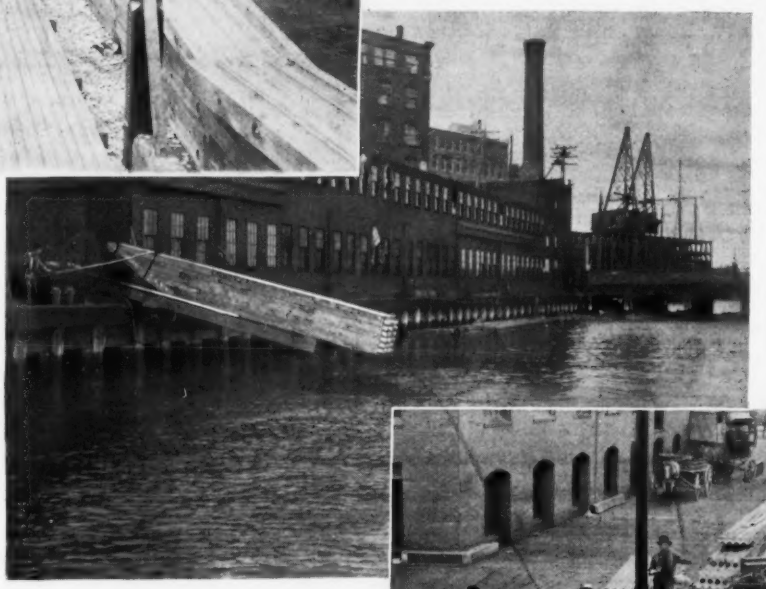
which has now in course of erection a splendid new generating station in South Boston, to take the place of its four older stations in other parts of the city. It may be remembered that President F. A. Gilbert and Assistant General Manager Sidney Hosmer, of this company, before the erection of this station was undertaken, visited Europe, inspecting the latest alternating-current practice there, and they have laid out a very perfect system, a more complete description of which will appear later in these columns. The transmitting system from the new station into the city consists of two double conduits, one of which crosses Fort Point Channel near the Congress Street bridge. Each of these double conduits carries twenty-four ducts in four layers of six ducts each, they being double in the sense that the twelve ducts on one side of a vertical plane through the centre of the conduit run through manholes entirely distinct from the twelve on the other side, so that in case of a manhole explosion or heavy burn-out, the whole line will not be interrupted. The line passes under two bodies of water and will have two similar conduits, a description of one of which, that under Fort Point Channel, will suffice, except in the matter of length, for both.

The conduit differs from all previously built in that no iron pipes are used, and the lead-covered cables will be drawn into ducts solely of wood. It is made of green pine, the six layers of ducts consisting of semicircular grooves planed in the opposite sides of seven layers of timbers, each layer being 6 inches thick. The timber is untreated green pine, except for the sections passing through the mud line at the two terminals of the conduit, which for a dis-

*See The Electrical World February 19, 1898, page 239, and June 19, 1897, page 805

tance of 12 feet—6 feet each side of the mud line—are of oak. This is for the purpose of avoiding the attacks of insects, which, experience has shown, are only made at these points. The timbers are fastened together at frequent intervals by ⅞-inch galvanized iron bolts with nuts and washers, and also with kiln-dried soft-pine dowel pins, the former being expected to have a limited life and the latter to be more permanent. The swelling of the latter on reaching the water will render them very tight. These bolts and pins are passed through horizontally and vertically at intervals, making, with the staggered joints of the timbers, a very substantial construction. The bolt holes are counter-bored on one side of the conduit, in order to give a smooth surface for the launching, which was done from sliding ways. The length of the 6-inch timbers varies from 4 feet on the curves to 20 feet on the straight run. The work was in charge of Mr. C. L. Melvin, superintendent of woodwork for the company, from whom many of these details were obtained, under the general direction of Mr. David Harrington, who is in charge of the underground part of the distributing system, and was done at the wood works of the company, which are on the shore close to the point where the conduit was sunk. The sections were grooved



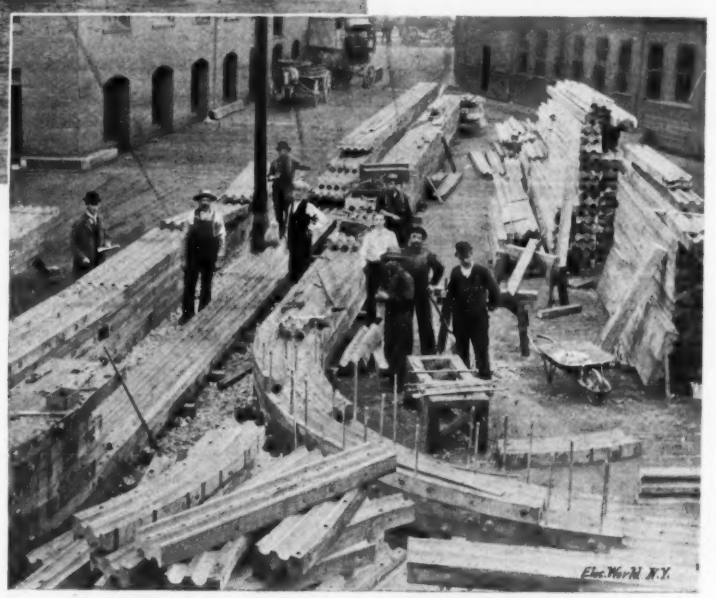


by a straight buzz planer, the curved sections being made up by the same planer with the simple addition of a curved guide, against which they were run.

They were assembled in the yard complete, except for the dowel pins, and the ducts were tested by means of a 3¼-inch plunger attached to a bamboo rod for the curved runs, any sticking being remedied by taking down the structure and gouging out the ducts. At the joints each duct is flared out slightly to prevent a shoulder occurring to catch the piping. After the ducts were thus carefully rendered of a uniform minimum cross-section, each of the six sections of the conduit was assembled, fitted with dowel pins and taken on rollers to the launching ways, a view of which, with one of the straight sections just leaving the ways, is shown herewith. The conduit is quite heavy, weighing in air a ton for about every 8½ feet, making for the whole length a weight of about 40 tons. The launching ways were heavily lubricated with axle grease, and the back end was tilted up with jacks until the section slid off into the water. Each section was fitted with a stepped joint, with steps each 2 feet in length for attaching it to the next. These were joined in the water and the whole sunk with weights, its normal flotation being about 50 per cent.

The conduit starts at each end in a sort of cable house, running down vertically through the floor, and to a depth of about 43 feet, the horizontal distance between the two vertical lengths being 205 feet, the vertical runs being connected with the horizontal bottom section by means of curves with a 10-foot radius. The leads will come into these terminal houses through ordinary subterranean conduits of cement-lined pipe in concrete, and be there spliced. In the clay bottom a trench was dredged to a depth of 7 feet to receive the conduit. The conduit, when floating on water, was sunk by raising the two ends by lighters and loading the long centre tangent by weights until its tendency to float was overcome. The work has but recently been carried out, and is not yet finished. The majority of the ducts will be filled each by a number of small ¾-inch lead-covered cables.

For the illustrations and much of the information concerning this conduit thanks are due Mr. P. F. Dolan, electrical engineer and chief inspector of underground work to the wire department of the city of Boston.



VIEWS OF BOSTON ELECTRIC LIGHT COMPANY'S CONDUIT UNDER CONSTRUCTION.

A Trial of Sectional Conductor Traction in England.

A practical trial of electric traction in the streets with the so-called closed-conduit system of current supply, but more properly termed a sectional-conductor system, has been on trial in Leeds. One mile and a half of track has been laid in a hilly suburb of the city, with underground switches supplying current to the car through phosphor-bronze buttons in the streets and skates carried by the car. It is said that the tests proved the system to be very satisfactory.

Tramways in Gothenburg.

A consular report states that a committee appointed by the city government of Gothenburg has recommended that the city shall build electric power stations and four electric railway lines with overhead construction to be used by the present tramway company, on the payment of certain dues, etc., amounting to about $42,000 per year and 12 per cent. of the gross receipts over and above $107,000 per annum. The company is to provide the rolling material, and the city will take over the rolling stock by purchase and undertake the management after twenty years. The estimate of the Siemens & Halske Company is that the total cost of construction, including the sites and buildings, will amount to about $500,000.

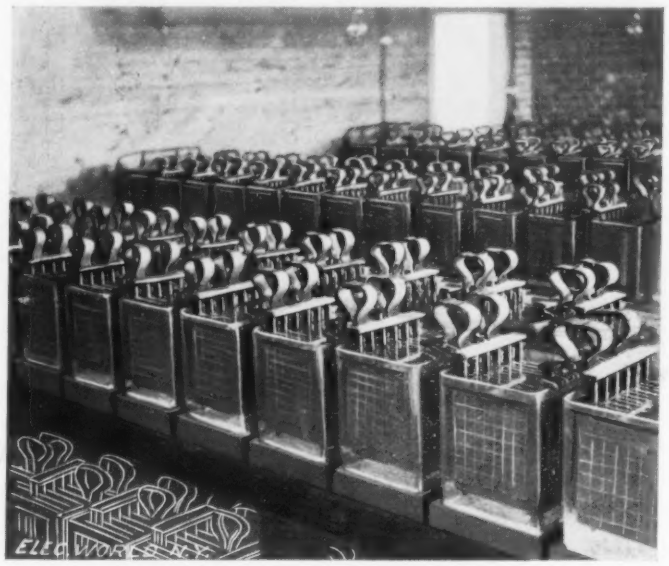
The Storage Battery Auxiliary of the Brunswick Traction Company.

MANAGERS of street railways operating in sparsely settled communities, with lines necessarily long to serve the scattered population, and perhaps desiring to extend their systems to neighboring towns, are often perplexed by the problem of the distribution of power. The distances soon become too great for economy at 500 volts; small separate power stations are out of the question, owing to the low economy in every way, and if, as is often the case, the lines are single-track, with only an occasional service, perhaps thirty minutes' headway, even high-tension power transmission and sub-stations with running machinery are out of the question, owing to the high cost of attendance of such stations per car-mile run on the limited trackage that they can reach. Managers of such roads will find one solution of this difficult problem in the installation described below.

The Brunswick Traction Company operates lines in New Jersey, connecting among other towns New Brunswick, Metuchen and Bound Brook, the total mileage of track being 51 miles. The power station is situated about 3½ miles east of New Brunswick on a line running out toward South Amboy, this point being distant about 11½ miles as the copper runs, from the terminus of the line in Metuchen. The maintenance of a reasonably constant potential without an excessive cost of copper on such a long feeder, especially with the high load peaks of an excursion business (the line passing through a picturesque wooden and farming district), is obviously a serious problem, and a solution is sought in this case by the use of a storage-battery sub-station situated about 3 miles from the Metuchen end of the line and therefore about 8½ miles from the power house.

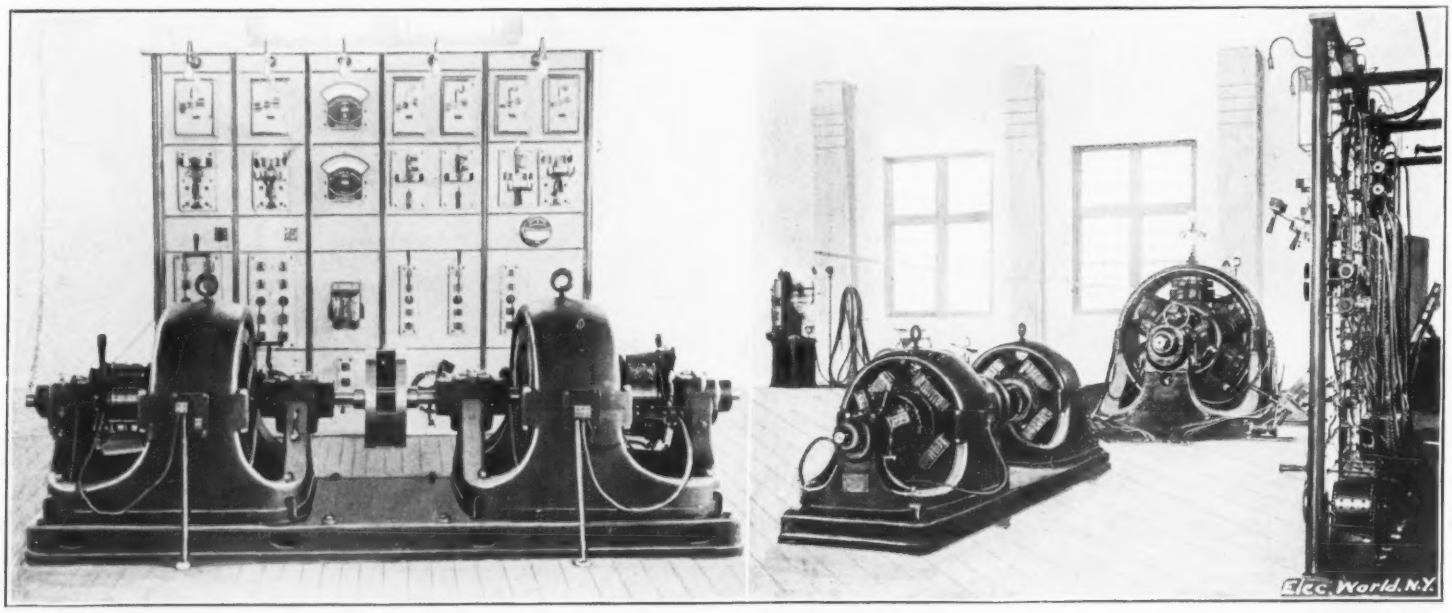
This battery has now been in service about two months. It consists of 258 cells of chloride accumulators, furnished by the Electric Storage Battery Company, with a nominal output of 100 ampere hours at a 45-minute rate. The cells are of glass mounted on sand in wooden trays, the latter being in turn supported on glass insulators on wooden frames heavily painted with acid-proof paint. To give flexibility the cell terminals are connected by inverted U-shaped lead loops, the halves being burned together at the top of the loop. The arrangement is in two tiers, one vertically above the other, and two rows, one beside the other, between each two aisles. The battery occupies the rear room on the ground floor of a small brick residence, which is further occupied by the family of one of the road's motormen. The wife of the motorman, in addition to her domestic work, serves as a battery attendant, her duty in this line consisting of throwing in the circuit breaker whenever it is opened by an excess charge or discharge.

The switchboard of the sub-station is located in one of the front rooms of the house and consists of a slate panel fitted with a Weston round-type voltmeter and a central-zero ammeter with an I T E circuit breaker and two quick-break single-pole single-throw switches and a three-point voltmeter switch. The battery is connected straight across between the overhead system and the ground, the feeder coming from the direction of the power station being



View of Storage Batteries.

tapped off to the trolley wire for some little distance back. This incoming feeder and that running out in the opposite direction, that is, supplying the line still more distant from the power house, are brought respectively through the two switches above mentioned while the ammeter and circuit breaker are in at the negative end of the battery and thereby carry the full battery current. The voltmeter positions are respectively connected to measure the voltage of the battery, of the incoming and of the outgoing feeder, all of which voltages are the same when the switches and circuit breaker are closed, but may differ if any one of these three instruments is opened.



Two Views of the Motor-driven Booster and Switchboard.

At the power station 8½ miles away the main equipment consists of two 225-kw Westinghouse multipolar railway generators,

each belted to a Cooper-Corliss cross-compound engine. For the feeder running out toward the battery a special motor-driven booster is installed, consisting of a 50-kw Westinghouse motor directly connected through a flexible coupling with a generator of similar capacity mounted on the same bed-plate, the whole resting on the wooden floor of the station, supported by 12-inch x 12-inch timbers at a position directly in the front of the switchboard. Both motor and generator have plain shunt-field windings with the ordinary field rheostats. The speed of the set is supposed to be 800 r. p. m., at which the dynamo should give 250 volts, its rated carrying capacity being 200 amperes. The set is controlled by one panel of the switchboard, the motor-supply circuit passing through an ordinary double-pole single-throw switch, an overload circuit breaker and a motor starter with automatic low-voltage release. One terminal of the dynamo is permanently connected to the positive bus bar of the station and the battery feeder is connected to a single-pole double-throw switch in such a way that it may be thrown either to the other pole of the booster dynamo or directly to the positive bus bar. A round-type Westinghouse voltmeter measures the pressure of the booster and two Westinghouse ammeters measure respectively the current taken by the motor and the current delivered by the booster. The battery feeder, after leaving the throw-over switch mentioned above, is led to a Westinghouse circuit breaker with a special attachment to prevent the battery backing up in case the station voltage runs down. This attachment consists of a fine-wire shunt coil wound in conjunction with the regular series coil to excite the plunger operating the trigger. When in use this shunt coil magnetizes the plunger with a polarity the reverse of that given by the series coil. With this arrangement in case the current in the feeder and the series coil dies out the shunt coil trips the breaker, while if the feeder is overloaded the magnetic effect of the series coil overcomes that of the shunt coil and magnetizes the plunger in the opposite direction, in this way also opening the breaker. Thus this simple addition makes an ordinary overload circuit breaker both an over and under load breaker with the same sensitiveness on both actions.

SWITCHBOARD AT SUB-STATION.

The booster is run regularly twenty hours a day, being started in the morning at the time the engine is started, 5 A. M., and run until 1 A. M. the following morning. The lowest voltage which the booster will conveniently give without serious field distortion, namely, 200 volts, is now in service, although this is found to be a little too high with the present load and the copper in the line. The pressure at the battery end varies around 600 volts, the battery being permanently overcharged and any small incoming current, such, for example, as 25 amperes, causing violent "gasing."

Mr. R. L. Rand, superintendent for the company, states that the battery reduces the fluctuations of the voltage to a negligible point, and is so satisfactory generally that a second set of twice the ampere-hour capacity has been ordered to be installed at Bound Brook, 11 miles from the power house.

Ferraris Memorial.

It appears that the fund for a permanent memorial to Galileo Ferraris is not being subscribed to as was expected. Neither the Italian Government nor the municipal authorities have contributed to it. The fund now amounts to only about $3000.

Telegraph Line the Length of Africa.

Work has been commenced on the construction of the British overland telegraph line from Cairo, Egypt, to Capetown. On the northern end the work has already reached Omdurman. A party is about to start for the upper Congo, and work is advancing at the southern end.

Electrolysis in the Cleaning of Metallic Surfaces.

BY C. F. BURGESS.

To one who has not had his attention called especially to the question the removal of foreign substances from metallic surfaces might at first thought appear to be a problem of little moment, and at least not one worthy of scientific study and investigation. Such, however, is not the case, as will be seen by noting some of the commercial applications of cleaning processes.

That metal which at the present time is of the greatest service to man would have its value greatly enhanced if it were not for the fact that it corrodes upon exposure to air and moisture. To prevent or reduce this corrosion as much as possible various methods are used to insulate the iron surfaces from moisture, air, or other gases by applying some kind of continuous coating to the metal. The principal forms of coatings are the paints, usually made by mixing lead pigments with linseed oil, applied in a thin layer which soon hardens, or by coating the iron surfaces with a thin coat of some other metal which will not corrode as readily as does iron.

The requirements for such coatings are that they shall be continuous and durable, protecting every portion of the surface, and that they shall adhere firmly to the metal. In order that these requirements shall be fulfilled it is essential that the iron present a clean surface before the protective coating is applied. The durability of the protective coating depends largely upon the thoroughness with which the metal has been cleaned, and the financial importance of the question may be seen by noting the enormous annual expenditures made by some of the railroads in keeping their bridges and other iron structures protected from corrosion.

The efficiency of the protection to iron afforded by dipping into molten zinc depends in large degree upon exposing a chemically clean surface to the molten metal, and this is even more the case when the protective metal is applied electrolytically. In the case of dipping, the so-called "galvanizing," small impurities on the surface are likely to be bridged over by the cohesion of the molten metal, which on cooling solidifies and thus protects the entire surface, even though the zinc does not adhere to every portion of it. This bridging over does not occur, however, when the coating is applied electrolytically, for the foreign substances on the surface, which are usually non-conductors, will prevent a deposit from forming in the localities where these impurities exist, and the difficulty of cleaning is the greatest obstacle in the way of successful electrocome soluble, or loosening them so that they may be easily removed by mechanical means. Another process which may be called a chemical one is the burning of the impurities by the application of a high heat, which, however, will act on only a small portion of substances found on metallic surfaces, such as lacquer and enamel.

Which of the above methods or combination of methods is used in practice depends upon various conditions, such as size and weight of work, character of metal, character of substances to be removed, and kind of coating to be applied. By some of the above methods the results may be obtained as completely as is desired, but there is still much to be wished for in the way of rapidity, convenience and cost.

lytic galvanizing of iron, which is so desirable from the many advantages which such a process has over the hot dipping process.

The success of any electro-plating work upon metal may be said to depend more upon the proper cleaning of the article to be plated than upon any other detail of the process, and this cleaning is one of the largest items of expense in an electro-plating plant.

The most common substances to be removed are oxides or other metallic compounds insoluble in water, which may exist from an imperceptible film to thick mill scale; grease or oils, as a result of handling or other previous treatment; paints, enamel, lacquer, etc., which may have been previously applied to the surfaces.

The means commonly used to effect this cleaning may be classified under the following divisions:

Mechanical.
Chemical.
Electrolytic.

In the mechanical means may be mentioned grinding, scraping, scratch-brushing, rubbing with pumice stone or other abrasive, and the use of the sand blast.

The chemical processes consist usually in employing a pickle or dip of some chemical substance, such as an acid or an alkali, which acts chemically upon the foreign substances, causing them to be-

The methods which seem to offer the best means of satisfactorily solving this important problem are the electrolytic processes, and it is the purpose of this paper to deal especially with such processes and to give some results of investigations along this line.

There might possibly be a valid objection to differentiating the electrolytic processes from the mechanical and chemical means above enumerated, for the electrolytic processes are similar to the other two in some respects. The passage of a direct current through an electrolyte decomposes that electrolyte and thus supplies the active agents which are to act chemically on the impurities on the metallic surfaces. The gases, also, which are liberated exert a physical action, and may thus act as a mechanical agent.

On passing the direct current through a solution of such a stable and chemically inactive compound as common salt, NaCl, the chemical action at the anode may be said to resemble that produced by a strong acid, or an oxidation, while at the cathode it is the reaction of an alkali, or a reduction. It is upon the utilization of these reactions at the electrodes that the electrolytic cleaning processes depend.

If the article to be cleaned is suspended as the anode in such a bath there will be a tendency of the oxides on the metal to dissolve, and for the metal itself to become attacked and go into solution, depending, of course, upon the metal and the nature of the electrolyte. In this respect it is similar to the acid pickling bath used so extensively for the removal of mill scale and rust from iron wire and other iron products. This "electrolytic oxidation" may serve as a convenient method for the removal of a thin coating of metal which has previously been deposited, replacing the electroplater's "stripping" solution.

The anode reaction will, however, have little or no effect on substances of an oily or greasy nature, but the chemical properties at the cathode afford all that may be desired in this direction. With the above-named electrolyte, sodium is liberated at the cathode, immediately uniting with the water, forming sodium hydroxide and hydrogen which rises to the surface. The reducing properties of the so-called nascent hydrogen thus formed are well known, and whether by the hydrogen alone, or by aid of the sodium, any oxide, sulphide, chloride, or similar compound on the metallic surface serving as the cathode will be quickly reduced to the metallic state.

The sodium hydroxide formed will attack the grease or oil, producing saponification exactly as is done in the electroplater's lye vat. In most cases, the chemical action at the cathode will in no way affect the metal itself, but will act only on the foreign substances present, thus allowing polished surfaces to be cleaned without destroying the finish. This is not the case with the anode reactions, which, in addition, are not effective in removing substances of a fatty or oily nature. It is seen, then, that placing the article to be cleaned as the cathode offers the most satisfactory method in plating work.

The availability of the cathode reactions for cleaning purposes was recognized as early as 1841, as shown by a British patent, in which this process was included as one of the claims of a plating process. At that time the only source of current was the voltaic cell, and the expense of the electric energy thus developed prevented a commercial application of the process. Now, however, with the sources of cheap electrical energy at hand, the method is meeting with some considerable attention, with promise of greater development in the future.

The method usually adopted by electroplaters for cleaning objects preparatory to plating is to take them as they come from the grinding and polishing wheels and immerse them for some time in a bath of hot lye to effect the saponification of the oil and grease. To complete the cleaning the surfaces are brushed with whiting or other similar material, which operation adds very materially to the cost of labor in such a plant. After this brushing the article is rinsed with clean water and it is then ready to go to the plating vat unless the operation has been slow and the metal has been exposed for some time to the air, in which case a film of oxide will frequently form. To remove this oxide an acid dip is employed, in which the article is immersed for a few seconds, then thoroughly rinsed with pure water and transferred immediately to the plating solution. Some metals, such as zinc, brass, pewter, and other alloys which will not stand the action of the lye bath, have to be cleaned by other means, such as by the use of benzine or potassium cyanide, which are of considerably greater cost and are a source of danger to the workmen.

During the past year an electrolytic method for cleaning has been used almost exclusively in the plating department of the electrolytic laboratory of the University of Wisconsin, and the marked advantages over the old methods will warrant a continuation of its use. The equipment for the work consists simply of a wooden vat similar in construction to a plating vat, with conducting rods of brass tubing connected to the leads from the dynamo. The solution which was first employed consisted of a strong solution of sodium chloride, the anodes consisting of carbon plates, 8 inches by 12 inches, connected permanently to the positive terminal, and suspended on both sides of the vat. The article to be cleaned is wired, as in preparation for plating, suspended for a few minutes from the cathode bar, then rinsed in clear water and transferred to the plating solution.

With a fairly high current density the oxides and similar compounds are reduced, and oils and grease quickly disappear, so that clear water will run freely over the entire surface. The bubbles of gas which are formed uniformly over the entire cathode surface serve to remove any loosely adhering non-conducting particles, thus avoiding the necessity of a brushing by hand.

The use of sodium chloride as the electrolyte is very objectionable, however, when a large amount of cleaning is to be done, owing to the offensive nature of the chlorine gas which is given off at the anode and which escapes into the air. A solution of sodium hydroxide is much more satisfactory on this account, as the oxygen liberated at the anode produces no harmful effect, but on the other hand this solution has the disadvantage of foaming when worked rather hard, which not only conceals the article from view while in the solution, but tends to retain the products of electrolysis, hydrogen and oxygen, which are liable to become ignited upon removing work from the tank, producing an explosion which may cause a spattering of the electrolyte.

The properties which a suitable electrolyte should have are: First, it should be a good conductor; second, it should contain no metal ion which is likely to be deposited upon the article to be cleaned; third, the gases given off should not be of an offensive or dangerous nature; fourth, the electrolyte should be one which does not foam, thus obstructing the view and preventing the free escape of the gases into the air.

The anodes should be of a conducting material which will not become attacked by the anode products. Carbon of certain qualities is probably as satisfactory a material as any, though even this will gradually wear away, the rapidity depending somewhat upon the nature of the electrolyte, but more largely upon the firmness and density of the carbon. One of the difficulties attending the use of carbon plates is the connection of the plate with the positive bars, for the suspending wire is sure to corrode at the point of contact with carbon unless special precautions be taken. This corrosion would introduce such a high resistance as to practically stop the flow of current. The following arrangement will entirely obviate the difficulty, and carbon plates which have been thus fitted up have been in use for over a year, with apparently as good electrical contact now as ever. Two holes about one-quarter inch in diameter are drilled through the plates near the top. The upper portion of the plate is then given a fairly heavy coating of copper, in a copper sulphate bath. This is then "tinned" with soft solder and placed in a mould into which molten lead is poured. The lead lug thus formed insures a permanent contact with the carbon, and a lead strip will serve best as a means of suspending the anode in the tank.

With many solutions it does not matter whether the lead lug dips into the solution or not, but in others the lead would get into the solution and thus spoil it for the purpose in view.

The electrical energy necessary to effect the cleaning of articles of iron or copper as they come from the polishing room may be taken as approximately equal to that used for the electro-deposition. Although the current density must be considerably greater for cleaning than for plating, the time is much shorter. Current density has a marked effect upon the rapidity of cleaning, and the disappearance of foreign substances in no wise follows Faraday's laws. The following figures taken from some observations made by Mr. H. A. Smith illustrate this very clearly. The measurements were made to determine the effect of current density upon the rapidity of removal of a film of grease from an iron surface, such as it acquires from a grease polishing wheel. The electrolyte was a nearly saturated solution of sodium chloride:

Current Per Square Foot.	Time Necessary for Cleaning.
20 amperes.	15 minutes.
40 "	3.5 "
140 "	0.75 " about.

With a solution of potassium hydroxide a current density of 80 amperes per square foot cleaned the iron almost instantly.

It is obvious that the high current density is the more economical from the fact that the length of time is not inversely proportional to the current density, but varies more rapidly. With a density of 40 amperes, which may be readily obtained at a pressure of about 5 volts, the cost of power for cleaning, per square foot, would be about .06 cents, assuming power at 4 cents per horse-power hour.

Some of the advantages of the electrolytic method of cleaning over that commonly used in an electroplating plant are the following: There is less complication from the fact that the cleaning vat may be of similar construction to the plating vats, and connected to the bus bars in the same way. There is a considerable saving in labor and material in dispensing with the hand brushing. After once wiring an article there is no need of touching it with the hands, for it may be transferred directly from one tank to another. The oxides and other metallic compounds may be removed simultaneously with removal of grease and dirt, thus avoiding the use of a cyanide or an acid dip. A metal which has a brightly polished surface may be cleaned without destroying the polish.

That the gases liberated at the cathode have a very remarkable physical effect in removing non-metallic coatings from a metal surface was demonstrated in an attempt to protect a portion of the cathode surface from the deposition of a metal in a plating solution. It was found difficult to apply an insulating coating which would not peel off as soon as the current density was high enough to cause liberation of gas bubbles. These bubbles seem to form between the metal surface and the non-conducting coating, thus forcing the two bodies apart. This phenomenon seems to be entirely unassociated with a chemical reduction of the coating in question.

This phenomenon might readily be put to a commercial use in the removal of paint, lacquer, enamel, etc., from metal articles which are to be refinished.

Tests of Furnace Gases in Combustion Engines.

From a paper entitled "Expériences sur L'Emploi Direct des Gaz des Hauts-Fourneaux dans les Machines Motrices," by Aimé Witz, published in "La Revue Universelle des Mines," and reprinted in pamphlet form, the following abstract has been translated. The object of the tests was a study of the practical use of the gases derived from coking furnaces in single-cylinder engines of large size. For a settled conclusion on this point it is necessary to make a prolonged trial to show whether these gases with their variations of quality and pressure will give continued and regular work. The tests were also conducted to give an exact determination of the consumption of gas, oil and water, the latter both for the cooling of the cylinder and the washing of the gas under normal conditions of industrial work. The engine was of the type known as "simplex" constructed at the shops of La Société Cockerill, with the following dimensions: cylinder diameter, 32 inches; stroke, 40 inches; 105 r. p. m. and a rating of 200 effective horse-power. It was decided to give this engine a continuous test of twenty-four hours, developing its normal power, missing about 10 per cent. of the admissions in order to give the usual reserve necessary in practical work.

The gas was furnished by four coking furnaces without any change whatever in their general arrangement or firing, and the trial thus had no conditions more favorable than would be found in regular practice. The power was absorbed with a brake water-cooled and weighted to measure the load. A speed counter, recording tachometer, Crosby indicator, thermometers and a specially calibrated gas meter were also used to get complete data. The principal data of the test are given in the following table:

Date, 19th and 20th of July, 1898.
Duration, 24 hours.
Average speed, 105.2 r. p. m.
Mean brake horse-power, 181.16.
Average number of admissions, 47 per minute.
Ratio to total cycles, 85 per cent.
Temperatures of the exhaust, 480° to 510° C.
Temperatures of the water:
Entering jacket, 22.7°.
Leaving jacket, 33.7°.

The various tests of gas consumption gave an average of 3.33 cubic metres (about 130 cubic feet) per brake horse-power hour. The water used by the scrubbers amounted to 30 litres (about 1 cubic foot) per horse-power hour, and by the cylinder to about 72 litres (2½ cubic feet). Of lubricants there was used altogether 17.3 grams per horse-power hour.

The general conclusions given in the paper are that the motor developed 181 horse-power with more than 10 per cent. of the admissions suppressed, and thus retained a considerable reserve capacity, and that the load was carried for twenty-four hours without trouble, and the consumption of the gas did not vary from one hour to another, and the calorific power of the gas remained close to 991 calories, the low average consumption of 3.33 cubic metres per horse-power hour being not only remarkable but almost unhoped for. The consumption of water and oil was better than had been anticipated, and it is expected that this can be yet reduced. The speed regulation is stated to be as good as can be obtained with the steam engine, and the variations of the quality of the gas did not affect its power sufficiently to be noticed in the engine performance.

Camille A. Faure.

The tardy report of the death of Camille A. Faure on September 14 has just reached this country. The name of Faure instantly calls to the mind of the electrical engineer his chief title to distinction, namely, his improvements of the storage battery, he being the first to build up the negative "pasted" plates with prepared spongy lead in place of the tedious and expensive Planté process of preparing the substance electro-chemically. Camille A. Faure was born May 21, 1840, at Vizille, in the mountains of Dauphiné, of an old French family of peasant landowners. Although he received some education at the Ecole des Arts et Métiers, he was largely self-taught.

Camille A. Faure.

His first employment was as a mechanical draughtsman and superintendent of construction with various large iron works in France and England, his work in the storage battery field making its first evidence in 1878 when he discovered the value of spongy metallic lead for the negative plates, the use of sulphate of lead being invented two years later. In 1882 he further improved the battery by adopting methods of increasing the surface of the plates with a given volume, and still later he did his part in the development of this branch of electrical engineering by improving the means of surrounding the plates with a porous covering, the idea of which was probably original with him.

Besides his work on the storage battery, M. Faure added to the world's knowledge of applied physics by other inventions, among them improvements in the manufacture of explosives, a system of signals used on shipboard and the application of electricity to the separation of chloride of sodium and to the preparation of various artificial fertilizers and the production of aluminum, and during the latter part of his life by improving explosive engines for automobile work. M. E. Hospitalier, editor of "L'Industrie Electrique," states of him: "All who have known him recollect well his indefatigable industry, his strong mentality and the originality of his ideas; a man with whom, as is rarely the case, theory and practice were always happily combined, and regret the loss of this inventor, who, although externally a little brusque, possessed an excellent heart."

DIGEST
of CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering

Dynamos, Motors and Transformers.

ELECTRIC GENERATORS. Parshall and Hobart. Lond. "Engineering," Oct. 7.—In this continuation of their long serial they discuss the effect of armature reaction in two extreme cases, showing that by using the proper number of poles a machine can be made to operate entirely satisfactorily as regards sparking. Multiple circuit windings, multiple windings, and two-circuit coil windings are briefly discussed. They then consider the voltage per commutator segment as related to inductance; this voltage is not always a true criterion of the inductance of a coil; the value for the average volts per commutator bar also varies according to whether carbon or copper brushes are used.

PHASE TRANSFORMERS. Meyer. Lond. "Elec. Rev.," Sept. 30, and "Science Abstracts," July.—A brief, illustrated abstract of the article noticed in the "Digest" May 14.

Lights and Lighting.

ELECTRIC LIGHT ON TORPEDO VESSELS. Pontifex. Lond. "Elec. Eng.," Oct. 7.—A short article on the electric light on torpedo boats on which all the lights are turned off when the searchlight is in use, in order that only one dynamo will be required. It is chiefly a description of the prevailing methods used on the British vessels.

DROP OF VOLTAGE IN THE ARC. Mrs. Ayrton. "El'ty," Oct. 19.—An abstract of the paper noticed in the "Digest" Oct. 15.

ELECTRICAL DECORATIONS AT CINCINNATI.—"West. Elec.," Oct. 15.—Some illustrations of some of the decorative lighting effects on the occasion of the recent national encampment of the G. A. R.

Power.

ELECTRICAL ENERGY IN BULK.—Lond. "Engineering," Oct. 7.—A leading editorial on this subject, referring to some of the schemes under consideration. In the Midlands it is proposed to erect a station to supply energy within a radius of 26 miles, including a number of important towns; another plant is proposed at Wolverhampton. The subject of the possible economy is discussed, some figures being given, and it is shown that the economy is not to be sought in fuel only; if the energy is to be sold at 2 cents per kilowatt hour, or less, which must be the case if some of the schemes are to be successful, coal will be one of the largest items of the works' costs; its cost can scarcely fall below 0.2 cents per unit, assuming the station to be at the mines; but coal can be delivered 10 miles by canal boats at 25 cents a ton, which amounts to 0.064 cents per unit, and there is, therefore, no advantage in placing a generating station at a distant coal mine if the expense of transmission is considered. Attention is called to the great difference between supplying the energy for power and for lighting.

ELECTRIC CAPSTAN AND TURNTABLE GEAR.—Lond. "Engineering," Oct. 7.—The beginning of a well-illustrated description of those used on the Northern Railway of France for hauling cars or moving turntables. Owing to the intermittent nature of the work the current is supplied from accumulators.

PUMPING PLANT.—Lond. "Elec. Eng.," Oct. 7.—A brief description of a recently installed plant at a coal mine, which is said to be the largest installation of pumping machinery in the United Kingdom; 5 tons of water are pumped for every ton of coal taken out.

ELECTRIC STEERING OF SHIPS. Gentsch. "Elek. Anz.," Sept. 22 and 25.—The conclusion of his long, illustrated article (see "Digest" Oct. 8).

WATER-POWER PLANT. Giovaninelli. "L'Eclairage Elec.," Oct. 1.—The first part of a long, illustrated description of the project of Sartori to utilize the fall of the river La Kerka, in Dalmatia.

POWER TRANSMISSION PLANT.—"Eng. and Min. Jour.," Oct. 15.—An illustrated description of the water-power plant in the Boisé basin, of Idaho, from which power is to be furnished electrically to two dredging companies. The description refers only to the hydraulic engineering features.

Traction.

TRACTION POWER MEASUREMENTS. Schiemann. "Elek. Zeit.," Oct. 6.—A long description of some extended tests which he made on a number of accumulator cars running in Berlin, the object being to measure the watt hours used by the motors; also to find what the capacity of the batteries should be for a whole day's service without recharging. He experimented with six different cars with different motors and connections; he endeavored also to find the best relations for accumulator traction, and therefore used both series and shunt motors and connected them in various ways. In running the cars the chief regulation of the speed was accomplished by connecting the two halves of the battery in parallel and in series, the intermediate steps being obtained by varying the fields; the tests were made under the exact conditions of practice, except that the car was loaded with a constant weight. He remarks that with gradual acceleration, making up the time lost thereby by using the highest speeds, a very much more favorable consumption of watt hours would have been obtained; (the question of acceleration, however, does not seem to have been included in the present tests). All the cars used had four axles and two pivoted revolving trucks; the battery had a capacity of 330 ampere hours at 30 amperes; five of the cars weighed partially loaded 20,200 kg each, of which the battery was 6840; the sixth weighed 17,600 kg, including the battery of 5000 kg. One of the conclusions was that the series motors gave the same effect as the shunt motors with their complicated switching arrangements and that it is therefore unnecessary to use shunt motors. The results are summarized in a table, from which it appears that the average weight is 21,200 kg, the number of stops per km 1.87, the mean consumption of watt hours per ton kilometer 27.75, the speed for the parallel connection 14.3 km per hour and for the series connection 23.6. From his tests he draws a number of conclusions; the reserve of the battery is too small; it should, at the start, be at least 100 per cent.; the unavoidable current rushes can be so great as to have an unfavorable effect on the battery unless the controller is handled very carefully. The interruptions in the regular traffic are so unavoidable that they must be taken into consideration in determining the size and capacity of the batteries; instead of a fuse he recommends circuit-breakers, as it takes too long to replace the fuse. The makers of accumulators should provide a simple means of determining in advance whether there is enough energy left in the battery for another complete trip. Good results may be expected from a re-charging station at a certain point on this line. The different connections of the motors had no appreciable effect on the consumption of power; it is much more important to have simplicity instead of a high efficiency; this he discusses in detail, calculating a case to show that the loss of time and money in repairing is greater than the gain, due to a slight increase in efficiency; the recovery of current at stopping is too inappreciable to be considered an advantage in favor of shunt motors; for trolley lines, however, shunt motors might be justified on a very hilly line, as the strain on the stationary machinery is less.

DIFFERENT TRACTION SYSTEMS COMPARED. Ziffer. "Elek. Anz.," Sept. 25, Oct. 2 and 6.—The first parts of a long article in which he discusses the advantages and disadvantages, which have been found by practice, of the various different systems of electric traction. He divides the number of systems into eight groups and discusses each separately; the trolley system is again divided into eight different classes.

SURFACE CONTACT SYSTEM. Brown. Lond. "Elec.," Oct. 7.—A note calling attention to the fact that in the Thompson system (described in THE ELECTRICAL WORLD Oct. 22) a traction engine or steam roller would short-circuit the system at each of the surface contacts; moreover, there would be considerable leakage through the numerous shunt-exciting coils on a long line. He considers the Diatto system preferable. Thompson, in reply to the criticism, stated that the contact bar on the car must be at the line voltage, or nearly so, so that the presence of a mere mass of iron would not affect the contacts.

ELECTRIC RAILWAYS IN LONDON.—Lond. "Elec. Rev."; more briefly in Lond. "Elec.," Oct. 7.—A communication to the London County Council by Robinson, containing a map of the roads projected and partly under construction in the western suburbs of London.

ELECTRIC TRACTION PATENTS IN ENGLAND.—Lond. "Elec.," Oct. 7.—A brief discussion of the scope of the fundamental patents in England.

ACCUMULATOR TRACTION. Drouin. Lond. "Elec. Rev.," Oct. 7.—A translation of the abstract of his recent paper, noticed in the "Digest" Aug. 20.

EFFICIENCY OF RAILWAY MOTORS. Fischinger. "Science Abstracts," July.—An abstract, with the table, of the article noticed in the "Digest" Jan. 15.

AUTOMOBILES. Reyval. "L'Eclairage Elec.," Oct. 1.—The continuation of his long, illustrated abstract of the report of the commission of the French Automobile Club. It contains considerable data of various vehicles and external views of a number of them.

ELEVATOR UP MONT BLANC.—"Elek. Anz.," Oct. 2.—A note on the project of the French engineer, Isartier. He proposes to construct a vertical shaft 1.5 miles deep, connecting it with an inclined tunnel 3.5 miles long; the tunnel will rise 600 feet to a height of 7500 feet (presumably above the sea); the vertical shaft is to be 10 to 13 feet in diameter and 8200 feet long.

THE ELECTRIC RAILWAY.—"St. Ry. Rev.," Oct. 15.—An article on the greatness and possibilities of the electric railway, which contains a number of interesting compilations and compari-

sons. Owing to the expansion of the cities of New York, Boston and Chicago, the density of population is gradually decreasing; the effects are shown of street railways on the distribution of population. Among the numerous compilations and comparisons the following may be of interest. In the States having the greatest street railway mileage more than half the population live in the cities. Every day the street cars carry as many passengers as there are inhabitants in Greater New York, Chicago, Philadelphia and Boston. To purchase the street railways would take all the coin, notes and certificates in circulation in the United States; the amount would easily pay the debt of the United States. The paying passengers amount to 2,260,000,000 per annum, which would be increased by 50 per cent. if the transfers were included. The cost of transportation on street cars and on steam cars is compared. Diagrams are given showing the population, area, miles of street railway, and average rides per capita per year in the six largest cities. There are 16,000 miles of street railways in the United States; the rails laid end to end would encircle the earth one and a third times. Two million three hundred thousand tons of coal per annum are used. Two hundred thousand men is the number of employees. The average car travels 120 miles per day, and in the course of a year each wheel passes over 8,000,000 rail joints; only 1 in 23,000,000 passengers is killed and only 1 in 800,000 is injured in any way.

STORAGE BATTERY ON ELEVATED ROAD.—"St. Ry. Rev.," Oct. 15; more briefly in "West. Elec.," Oct. 15.—An illustrated description of the operation of the battery on the South Side Elevated road in Chicago; besides showing the curves referred to in the "Digest" last week, some further data and some illustrations are given.

SUSPENSION RAILROAD.—"Sc. Am. Sup.," Oct. 15.—A reprint of the illustration, with a brief description, of the road between Eberfeld and Barmen, of which a brief description was noticed in the "Digest" Oct. 15.

TEST OF POWER PLANT. Munroe. "St. Ry. Rev.," Oct. 15.—An abstract of a thesis describing a test of the Lafayette, Ind., street railway power plant, operated by steam.

CRIPPLE CREEK RAILWAY.—"St. Ry. Rev.," Oct. 15.—An illustrated description of this road, on which three-phase currents, reduced to direct currents, are used.

STREET RAILWAYS OF CHICAGO.—"Eng. News," Oct. 20.—Long abstracts of a report to City Councils by a committee of which Harrison is chairman; it shows the need of some change in the relations between the city and the street railway companies.

DELIVERY WAGON.—"Can. Elec. News," Oct.—A brief, illustrated description of the first electric motor wagon to be used in Canada for a commercial purpose.

STREET RAILWAY CONVENTIONS.—"St. Ry. Jour.," Oct.—The whole of this issue is devoted to full accounts of the proceedings of the American Street Railway Association, the Street Railway Accountants' Association and the convention of the New York State Street Railway Association. Reprints of the papers and the discussions are given.

STREET RAILWAY CONVENTIONS.—"St. Ry. Rev.," Sept. 15.—A full account, with the papers, discussions and transactions, of the recent Boston convention of American Street Railway Association, of the Street Railway Accountants' Convention, and of the meeting of the Street Railway Association of the State of New York. Two of the papers are reprinted in the issue of Oct. 15.

Installations, Systems and Appliances.

FRANKFORT-o.-M.—"Zeit. f. Beleucht.," Sept. 30.—Long extracts and tables from the report of the operation of this alternating current station for the year ending in March.

BERLIN.—"Zeit. f. Beleucht.," Sept 20.—A short article showing the growth of some of the central stations in that city.

Wires, Wiring and Conduits.

WIRING RULES.—Lond. "Elec. Rev.," Oct. 7.—A brief discussion of the recent rules issued by the Manchester corporation. The fact that all fittings must be approved in writing by the corporation engineer is thought to be a step in a dangerous direction; it is not considered wise to worry consumers with every little detail; moreover, consumers will feel that if everything has received such approval they are perfectly safe; it is argued that only special apparatus should require special approval. Several other points are discussed.

SHIP WIRING. Bagot. Lond. "Elec. Eng.," Oct. 7; reprinted in "El'ty," N. Y., Oct. 19.—A short, illustrated article, giving some hints on the use of the single-wire system in which the negative pole of the dynamo is connected with the hull of the vessel.

Electro-Physics and Magnetism.

THEORIES OF ALTERNATING CURRENTS. Rhodes. "Roy. Soc. Proc.," 62, p. 348; abstracted briefly in "Science Abstracts," July.—The article deals with the complete investigation of the complicated arrangements of mutually dependent circuits. The method depends on the fact that if a simple harmonic function is differentiated twice in succession, the result is proportional to the original function. He also shows that any periodic voltages and currents can always be represented by simple sine curves, having the same root mean square value and suitable phase position, dependent only on the time constant of the circuit and on the periodicities of the harmonics present.

IMAGINARY QUANTITIES IN TRANSFORMER EQUATIONS. Pomey. "Science Abstracts," July.—An abstract, with some of the formulas, of the article noticed in the "Digest" April 30.

HIGH FREQUENCY AND HIGH POTENTIAL CURRENTS. Niewenglowski. "Cosmos," Sept. 24.—A short, illustrated article of a semi-popular nature, describing the apparatus as made by Radiguet, and experiments made with it.

CONTINUOUS-CURRENT SPECTRA. Kalaehne. "Wied. Ann.," No. 8; abstracted briefly in Lond. "Elec.," Oct. 7.—He used the continuous current from high potential accumulators, as this enables the spectra to be studied at a lower temperature, which sometimes does not exceed 100°; he used 600 cells and in a number of cases obtained band spectra as distinguished from line spectra.

RESISTANCE OF WIRES FOR ALTERNATING CURRENTS. Gray. "Phil. Mag.," Oct.—A short communication on the calculation of the virtual resistance of thin wires for rapidly alternating currents. He calls attention to a formula of his which Boynton recently quoted in his article on the high frequency induction coil, but from which he made some incorrect deductions; he corrects the error and shows that the formula is only approximate.

EFFECT OF GASES ON DISCHARGES. Wesendonck. "Wied. Ann.," 65, p. 553; abstracted in the "Elek. Zeit.," Oct. 6.—It has been stated that high chimneys are seldom struck by lightning, which was thought to be due to the gases; he made laboratory experiments from which he concludes that the gases are not the cause, as they tend to favor the spark discharge rather than to hinder it.

ELECTRICAL PROPERTIES OF GLASS. Gray and Dobbie. "Roy. Soc. Proc.," 63, p. 38; abstracted at some length in "Science Abstracts," July.—Descriptions of experiments undertaken to determine the circumstances which affect the conductivity and specific inductive capacity of glasses. Their experiments seem to show that when the composition approaches to a definite chemical compound the glass has a high resistance.

ELECTRICAL RESISTANCE OF METALS. Liebenow. "Science Abstracts," July.—A long abstract of his article which was noticed in the "Digest" last year.

ROENTGEN RAY THEORY. Walter. "Wied. Ann.," p. 74; abstracted in Lond. "Elec. Rev.," Oct. 7.—He claims that the adoption of the wave form is by no means universal; he assumes that Röntgen rays are composed of the same particles as cathode rays, after they have completely lost their electric charge by their impact on the anti-cathode. Measurements showed that the ratio of the charge to the mass of a cathode particle is about a thousand times as great as the same ratio in the electrolytic ion.

ROENTGEN RAY APPARATUS.—"Elek. Zeit.," Oct. 6.—A number of illustrations of recent forms of apparatus made by a German company.

CATHODE RAYS.—"Elek. Zeit.," Oct. 6.—An abstract of a paper read before the Hungarian Academy of Science, in which the author (the name is not given) gives a proof that the magnetic and electric deflections, and therefore also the velocity of the rays, may be changed by electrical influences.

DARK CATHODE SPACE. Wehnelt. "Wied. Ann.," 65, p. 511; abstracted in the "Elek. Zeit.," Oct. 6.—He shows that this space is not like a poor conductor but like a perfect dielectric.

CIRCULATION OF GASES IN CROOKES TUBE. Swinton. "Phil. Mag.," Oct.—Reprints of his two Physical Society papers, abstracts of which were noticed in the "Digest" June 25, on the "Circulation of the Residual Gaseous Matter in a Crookes Tube."

PHOSPHORESCENCE. Jackson. "Phil. Mag.," Oct.—A reprint of a long Brit. Assn. paper.

ZEEMAN EFFECT. Preston. Lond. "Elec. Rev.," Oct. 7.—The beginning of a long abstract of his Brit. Assn. paper in which he described experiments showing the visible separation of the lines into triplets, which he was the first to accomplish.

MAGNETIZATION OF CYLINDERS. Holborn. "Berlin Akad. Sitzber.," 10, p. 150; abstracted briefly in "Science Abstracts," July.—He endeavored to find the situation of the poles in a magnetized iron cylinder under various circumstances. For a cylindrical magnet 15 cm long the distance between the two poles varies between 10.8 and 13.7 cm, or between 72 and 91 per cent. of the total length. As the field increases, the distance between the poles first decreases and then increases again.

ALTITUDE AND TERRESTRIAL MAGNETISM. Rijckevorsel and Bemmelen. Lond. "Elec. Eng.," Oct. 7.—A brief abstract of their paper read before the recent conference on terrestrial magnetism, describing investigations with the influence of altitude above the sea on the elements of terrestrial magnetism. The experiments covered a period of two years, and were made on the Righi, one of the Alps. They conclude that they consider it proved that if there is any influence of the altitude it is so exceedingly small that it can hardly be detected with present surveying instruments, and it is therefore quite unnecessary to take altitude into account in magnetic surveys; if, however, it should be found that there should be such influence, it is more likely to be an increase of the vertical forces with the altitude than anything else.

TERRESTRIAL MAGNETISM. Schuster. "Phil. Mag.," Oct.—He discusses the possible effects of solar magnetization on the periodic variations of terrestrial magnetism.

INTERNATIONAL MAGNETIC CONFERENCE.—Lond. "Engineering," Oct. 7.—Brief abstracts of the papers read, some of which have already been noticed in the "Digest."

ROENTGEN RAY NOTES. Rollins. "Elec. Rev.," Oct. 19.—A continuation of his notes. He calls attention to the harmony between tubes and generators, claiming that the maker of the tube should know the kind of generator with which it is to be used, and after the tubes have been adjusted they should not be used on any other generator. The use of Rontgen light tubes for spectrum analyses is briefly referred to. He points out some advantages of the use of high e. m. f.; with his large machine, containing sixteen plates 6 feet in diameter, he found that radiant energy could be produced of the wave length required for Rontgen light, with a vacuum so low as to be equal to the resistance of one-sixteenth of an inch of air on this generator; this is an advantage, as it is easier for makers to furnish tubes with low than with high vacua; he recommends such generators where portability is not important. To dry the air in the enclosures around influence machines he recommends circulating the air by passing it over the chloride of lime by means of a blower.

RADIOGRAPH TUBES.—"Sc. Am. Sup.," Oct. 22.—A translation of an illustrated article from "La Nature," describing Villard's tube, which is regenerated by means of hydrogen, entering through a platinum rod, as has already been described in the "Digest."

CIRCUIT CONTROLLER FOR VACUUM TUBE LIGHTING. Tesla system. "Elec. Rev.," Oct. 19.—A reprint, with the illustration, of his recent patent for such a device.

ALGEBRA OF ELECTRICITY. Hellick. "Elec. Eng'ing," Sept.—The beginning of an elementary article intended for beginners; the present portion refers to the electrical units.

Electro-Chemistry and Batteries.

PHOSPHORUS. Kershaw. Lond. "Elec. Rev.," Oct. 7.—A short article on the electro-thermal process of the manufacture of phosphorus. After some brief historical notes he describes very briefly the Readman-Parker process, which is in use at Oldbury and at Niagara. Natural phosphates are heated, intimately mixed with carbon and a suitable flux, in the electric furnace, by means of a current passing between carbon poles; the heat is due to the resistance and not to the arc. The furnaces are small and capable of yielding 1.5 cwt. of phosphorus per day; the process is continuous; between 80 and 90 per cent. of the phosphorus contained in the raw materials is extracted; the Niagara works use 300 horsepower. This process is now established in four countries, and is replacing the chemical process. In considering the future of the industry he calls attention to the fact that most of the phosphorus is used in the match industry, and as there is a movement now to make matches without phosphorus, the phosphorus industry is at present in a very unsettled state.

ELECTRO-DEPOSITION OF SILVER AND ITS SEPARATION FROM COPPER. Kuester and Steinwehr. "Zeit. f. Elektrochemie," 4, p. 541; abstracted briefly in "Science Abstracts," July.—By following the usual published instructions the results were uncertain and unsatisfactory; these instructions err in requiring a certain current density instead of a constant voltage; for a good precipitation it is essential that the voltage should not exceed a certain value; over 100 experiments were made to find the most suitable conditions and it was found that perfect precipitation was obtained when the solution, whose volume was about 150 cb cm, containing about 0.5 gram of silver, is mixed with 1 or 2 cb cm of nitric acid of 1.4 sp gr and 5 cb cm of alcohol, the e. m. f. being kept constant at 1.35 to 1.38 volts for six to eight hours; excellent results were then obtained in the analysis of an ordinary coin.

ELECTRO-DEPOSITION OF IRON.—"L'Ind. Electrochem.," 7, p. 20; abstracted in "Science Abstracts," July.—The metal may be easily obtained, either as a powder or as dense and hard as tempered steel; the dense product contains a large amount of occluded hydrogen. For producing the powder the citrate or oxalate of iron is preferred, but the current density must be carefully regulated. For the dense deposit sulphate of iron is almost always used. The presence of chlorides should be avoided, as the metal will oxidize rapidly; the sulphate solution should be neutral, and should be mixed with some sulphate of ammonia, sodium or magnesium; the current density varies from 0.15 to 0.45 ampere per sq. dcm., and the voltage is 1 to 1.3.

INDUSTRIAL SEPARATION OF COPPER. Neumann. Lond. "Elec. Rev.," Oct. 7.—An abstract of the paper noticed in the "Digest" Feb. 5 and 19.

ELECTROLYTIC CONSTRUCTION OF FLEXIBLE, ELASTIC BODIES.—"Elek. Anz.," Oct. 2.—A note describing a process of Krueger. To obtain greater flexibility, repeated electrolytic deposits are made between, which is, for instance, graphite, which separates the layers either partially or entirely. If the bodies are to have rigidity besides great elasticity, layers of wires, bands, etc., are wound around the first deposit, after which more metal is deposited.

ELECTRIC CURRENT IN ORGANIC CHEMISTRY. Smith. "Science," Sept. 30.—A reprint of his A. A. A. S. paper. The first part is an historical summary of the subject of electrochemistry in general; the latter part is an organic chemistry, with special reference to the classic experiment of Kolbe and later developments; he points out the possible future, stating that the sketch which he gave must be regarded as merely the beginnings of electrolysis of organic bodies.

ALKALI PROCESS.—"Eng. and Min. Jour.," Oct. 15.—A note stating that a dividend was declared by the Castner-Kellner Alkali Company of Great Britain during the first six months, which shows that it has earned a profit from the start. (This company uses the electrical process.)

Units, Measurements and Instruments.

MAGNETIC HYSTERESIS AND FOUCAULT CURRENTS. Niethammer. "Elek. Zeit.," Oct. 6.—The first half of an article calling attention to the differences obtained in making measurements of hysteresis by the usual method and by means of the alternating current. He divides the apparatus into two classes, one in which the iron is magnetized and de-magnetized lineally (as in transformers) and those in which the iron is magnetized cyclically in all directions, as in revolving fields. For the designing engineer it is important to know whether the magnetic coefficients for permeability and hysteresis, which are found for one kind of magnetization, could be applied directly for another kind of magnetization; all difficulties are overcome if the permeability and iron losses are measured by a method in which the iron is subjected to the same processes as in the apparatus to be constructed: the results obtained by the magneto-static methods with ballistic galvanometers, etc., can therefore be applied directly only for the calculation of the fields of dynamos; for alternating-current apparatus the measurements must be made with the wattmeter or by a callorimetric method; moreover, it is not right to use the first magnetization of the samples of iron. In all his measurements he therefore determined the iron characteristic and permeability curve from the maximum magnetizing forces and inductions which form the points of a succession of hysteresis curves, obtained with the use of alternating currents. The curve obtained in this way and that obtained in the usual way are shown; the characteristic for the alternating-current magnetization is appreciably lower; for the same H and for $B = 3000$ the difference is 23 per cent., for $B = 5000$ it is 12 per cent., for 10,000, 8, and for 13,000, 7 per cent. The curve form of the voltage does not affect the magnetization and permeability; when the curves are decidedly unsymmetrical—that is, rising more rapidly than they fall, due to hysteresis—it is shown that the determination of the magnetization curve can only be accomplished properly by the use of alternating currents; electrodynamometric averages, such as are used by Steinmetz in his papers on alternating-current phenomena, may lead to entirely incorrect results; if the current curve is unsymmetrical and quite pointed the induction will be very high, while if it is flat then the induction will be lower and the Foucault current losses are appreciable. He shows that Steinmetz's hysteresis coefficient is decidedly not constant; between $B = 1000$ and 9000 a mean value can be used, but below 1000 or above 10,000 the Steinmetz equation is not permissible; the Steinmetz index, 1.6, varies in general between 1.7 and 1.9 for B less than 1000, or greater than 8000, and for values between 1000 and 8000 between 1.5 and 1.7; he urges that when the Steinmetz coefficient is given it should be added what induction is referred to. To say that the work of hysteresis is proportional to the number of cycles is not exactly correct; moreover, apparatus will heat from 40° to 50°, and with increasing temperature the hysteresis diminishes; for soft wrought iron and $B = 3000$ to 14,000 and for 10° C. it is about 1 per cent., the average for the ordinary load being a diminution of 4 to 5 per cent.; with increasing temperature the permeability also increases about 1.5 to 1 per cent. for $B =$ 4000 to 10,000; long heating of over 100° C. makes the iron poorer by about 5 per cent. to 10 per cent.; the Foucault current losses also diminish with increasing temperature: for 10° difference the variation is about 5 per cent. Turning or filing the plates after assembling should in all cases be avoided: in a continuous-current armature, for instance, the iron losses were thereby increased 1.5 to 2 times.

GALVANOMETERS. Ayrton and Mather. "Phil. Mag.," Oct.—A reprint of their long third paper, read before the Physical Society, an abstract of which was noticed in the "Digest" June 18.

ELECTRO-DYNAMOMETER IN SHUNT. Wien. "Science Abstracts," July.—An abstract, with the formulas, of an article on the use of shunts with electro-dynamometers.

MEASUREMENT OF PHASE DIFFERENCE. Rossi. "Science Abstracts," July.—The beginning of an illustrated abstract of the article noticed in the "Digest" May 21.

MEASURING THE CAPACITY OF CABLES WHEN LAID.—Lond. "Elec. Eng.," Oct. 7.—Brief, illustrated descriptions of several methods.

CAPACITY OF CONDENSERS. Lori. "Accad. Lincei. Atti.," 7, p. 150; abstracted in "Science Abstracts," July.—He describes researches made to find out whether anything analogous to magnetic hysteresis occurs when a condenser is gradually charged and discharged. He found that there is no evidence of such electrical hysteresis.

ANALYSIS OF PERIODIC CURVES. Weiss. "Rev. Gén. des Sc.," Sept. 15.—An article describing the application of the Hermann process which applies to periodic curves in general.

NATIONAL PHYSICAL LABORATORY.—Lond. "Elec.," Oct. 7.—A reprint of the report of the committee appointed by the British Treasury to inquire into the desirability of establishing such a laboratory. The committee makes the following recommendations: That such an institution should be founded for standardizing and verifying instruments, for testing materials, and for determining physical constants; the Royal Society should control it and nominate the governing body, with the secretary of the Board of Trade as an ex-officio member. The subject is discussed in the leading editorial.

EFFECT OF WAVE FORM ON CAPACITY AND INDUCTANCE MEASUREMENTS. Weber. "Annal. Phys. Chem.," 63, p. 366; abstracted, with some of the formulas, in "Science Abstracts," July.—In measuring capacities and inductances alternating currents are often used, with the assumption that they are of the simple sine form, but this assumption is in most cases incorrect; he endeavors to determine in how far the measurements may still be considered valid. He gives a rather complicated formula for calculating the correcting factor.

ALTERNATING CURRENT CURVE RECORDER. Callendar. "Can. Elec. News," Oct.—A reprint of the article which was abstracted in the "Digest" Sept. 17.

ELECTROSTATIC TESTING FOR OPEN CIRCUITS.—Hewett. "Teleg. Age," Oct. 1.—A description of his methods of testing at a terminal and at a way station of a telegraphic circuit.

Telegraphy, Telephony and Signals.

TELEPHONE CALL SYSTEM.—"Elek. Rundschau," 15, p. 97; abstracted in "Science Abstracts," July.—A brief description of Stock's system to do away with the necessity of talking on the part of the operator. In front of the microphone at the exchange is placed a small trembler, giving four beats per second, which is connected, and thus advises the subscriber that he is being attended to; when the operator is ready she disconnects this trembler, so that when the noise stops the subscriber knows that the operator is ready to receive instructions.

BLOCK SYSTEMS IN FRANCE. Walzel. "Elec. Tech.," Sept. 30.—A long, illustrated abstract of an article from the French describing recent progress in the block systems used on the Northern Railway of France.

VALLEY TELEPHONE CO.—"Elec. Eng'ing," Sept.—A well-illustrated description of this independent telephone company at Saginaw, Mich.

Miscellaneous.

ENAMELS FOR HEATING APPARATUS. Saglio. Lond. "Elec. Eng.," Oct. 7.—A brief abstract of his paper. He made researches with the properties of various enamels, and found that silica, kaolin, petalite and zircon make enamel infusible and insoluble, but give it less expansiveness; calcic phosphate increases the expansiveness, gives it viscosity in fusion and a certain insolubility; cryolite, fluorspar and, above all, rutile, increase the expansiveness and the fluidity of the enamel.

GUTTA-PERCHA. Obach. "Science Abstracts," July.—A long abstract of his recent Cantor lectures.

SPECIFICATIONS. McLaren. Lond. "Elec. Rev.," Oct. 7.—The beginning of a reprint of a paper on electrical engineers' specifications, referring more particularly to the mechanical engineering features.

VIENNA EXHIBITION.—"Zeit. fuer Elek.," Oct. 2.—The beginning of a report on electricity at the Jubilee Exhibition. The present portion refers to the electric lighting of the exhibition and the transmission of power.

ELECTRICAL INSTITUTE.—"L'Energie Elec.," Sept. 16.—A long, illustrated description of the Montefiore Electrotechnical Institute at Liege, Belgium, endowed by Mr. Montefiore; several views of the interior of the laboratories are given.

ACTION OF ELECTRICITY ON PLANTS. Cooke. "El'ty," Oct. 19.—A long abstract of the paper noticed in the "Digest" last week.

MARITIME ELECTRICAL ASSOCIATION.—"Can. Elec. News," Oct.—The reprints of the proceedings of the first convention of this association, including the presidential address and the reprint of a paper by Hamilton on electric gong buoys, in which he gives an illustrated description of his proposed method in which the buoys are connected by submarine cables.

Book Review.

LECTURE NOTES ON THE THEORY OF ELECTRICAL MEASUREMENTS. By Prof. William A. Anthony. John Wiley & Sons, New York; 12mo, vi + 90 pages, diagrams. Price, cloth, $1.

This work is the publication of the notes prepared for the third-year classes of the Cooper Union Night School of Science, of which the author is professor of physics. It is intended as a guide to the student, who is expected to take more elaborate notes of the lectures, serving to give an accurate outline and correct any important misconceptions in the student's mind. To those getting up similar courses the work should prove a good guide, and to those having such courses already established it will undoubtedly give valuable suggestions. The subject is an extremely difficult one to teach, owing to its rather abstract character and remoteness from practical every-day applications. Especially is this true of the fundamental derivation of the C. G. S. system of units, and any aid to teaching in this line is useful.

Exhibits of Electrical Interest at the Mechanic Fair, Boston.

The twentieth triennial exhibition of the Massachusetts Charitable Mechanic Association, lasting from October 10 to December 3, 1898, shows a notable advance over previous exhibits. At one time a food show filled with the stands of souvenir sellers and candy booths, the fair has developed until now it is an exhibition of great interest and value to visitors. The most remarkable feature of the present show is the number of electrical exhibits. A few notes of interest about these are given below.

THE DIESEL MOTOR COMPANY OF AMERICA, 11 Broadway, New York, has on exhibition the same motor that was shown at the New York electrical show at Madison Square Garden, and described and illustrated in these columns in the issue of May 28, 1898. In its present location, however, it is not direct-coupled to a generator, but is belted to a line shaft from which several neighboring exhibits are run. It is running on crude petroleum, known on the market as Eagle fuel oil. Mr. Edward Puchta, who is in charge of the engine, states that the company has decided to construct engines itself for sale instead of licensing other builders, and is about to proceed on this plan.

THE MAXHAM ELECTRIC THIRD RAIL COMPANY, Tremont Building, Boston, Mass., shows in operation an experimental model of a new design of sectional conductor street car system. The mechanism is very simple, the third rail being divided into insulated sections, below each of which is a section of similar length of ordinary round trolley wire supported on a pair of transverse rock arms in such a way that it may be tilted up against the surface rail proper, making a crude form of switch. The tilting is effected by means of a flexible depressible rail at one side, engaging the other end of the rock arms and depressed by a device on the car. The rod or wire switches are also intended to be used as a conductor by means of flexible leads attached to their ends.

THE GENERAL ELECTRIC COMPANY shows its electric railway around the world, which was described and illustrated in these columns in the account of the American Street Railway Association Convention, which was held in the same hall. This is supplemented by a few features not shown in the street railway exhibit, consisting of a large script sign of miniature lamps, a fence made up of street railway gears and pinions, with controllers for corner posts and insulators on the pickets, and other minor features. The General Electric Company supplied all the motors for driving the many exhibits throughout the building, which were almost entirely motor-driven, and several of the large generators for lighting and power purposes, and the building is lighted entirely, with the exception of the exhibition lights, by General Electric enclosed arc lamps.

THE U. S. ELECTRICAL SUPPLY COMPANY makes considerable of a show, this sort of fair being well adapted to the display of its wares. Mr. W. J. Clarke is on hand with the wireless telegraph set which was used in the New York show at Madison Square Garden, with the submarine bomb blowing up a ship and with the same X-ray apparatus. He takes particular pride in the latter, in that there are now in use the same coil and the same Crookes tube that were used in Madison Square Garden, the two having seen service of a length equivalent to four weeks of ten hours a day. The tube is pretty well blackened, but still emits X-rays plentifully. It is fitted with a shunt passed through a chemical which lowers the vacuum in case the resistance becomes too high. Downstairs the same company shows a Criterion acetylene generator, as manufactured by Messrs. J. B. Colt & Co., for whom the United States Electrical Supply Company is acting agent at the fair, as it is also for the Thermo-Electric Company, of New York City, the manufacturer of the Cox generators. The acetylene jets are shown in line with an electrical incandescent bulb, an ordinary fish-tail jet burning Boston gas, and some Welsbach mantles, shown by the Welsbach Company in the next booth. The competition does the acetylene no harm.

AMONG OTHER EXHIBITS AND EXHIBITORS are the Samson Cordage Works, of Boston; the Boston Gear Works; the New England Pump Company, showing rotary pumps and gas engines; Walter H. Foster, 126 Liberty Street, New York, showing a large line of machine tools and a motor-driven air compressor supplying several pneumatic tools; Moore vacuum tube light; the Mason Regulator Company, of Boston, showing automatic valves of many styles and a pump governor in action; the Hayden & Derby Manufacturing Company; the Consolidated Valve Company and the Ashcroft Manufacturing Company, the latter company showing a recording tachometer, giving on the tape a time record of the instantaneous variations of speed of the shaft to which it is belted, which in turn is driven by a Diesel motor; the Niles Tool Works, the particular feature of whose exhibit is the American patent pulley built up of steel plate punched and stamped to shape; the Ball Bearing Company, of Watson Street, Boston, which shows a line of ball-thrust bearings, the balls being maintained at a proper distance apart by two collars with apertures through which the balls bear, and journals in which rollers run and are maintained in alignment, not by pins through the rollers, but by strips between them and connecting to collars which prevent the rollers from slipping out endwise, and Jenkins Brothers, who show, besides a large line of valves, a new magnetic lamp holder, which is described at length in another column of this issue.

THE AMERICAN ELECTRIC HEATING CORPORATION, Cambridgeport, Mass., shows an extensive line of electric heating and cooking apparatus, as noted in the description of the Edison Company's booth. The largest pieces are two of the company's large ranges, consisting of nothing more or less than a slate table on which can be placed the electric heating apparatus and a slate panel fitted with eight receptacles for the plugs of the flexible cords to the various heaters. Below the slate table is a plate warmer kept at a moderate heat. Beside one of these ranges is an electrical oven, which at the time of the writer's visit was doing good service in roasting chickens for the restaurant upstairs. A bewildering array of other apparatus includes the following devices: A broiler, a small stove with a switch for giving three heats, sadirons, foot warmers, heating pads, soldering irons, glue pots, etc. One of the newest and most ingenious things is a portable heating coil shown in several

forms. This consists simply of a nickel-plated tube coiled into either a spiral or helical shape and containing resistances, one end of the tube rising to a considerable height, the whole being designed to be slipped down into anything that the user may want to cook or to heat, from a coffee pot to a soup kettle. The simplicity and usefulness of this device are obvious at first thought. Besides the two forms of coiled tube it is also made up in the form of a flat disc, with a vertical stem for the leading-in wires, this disc being more easily cleaned than the other, but giving with the same volume a smaller radiating surface.

THE WALWORTH MANUFACTURING COMPANY, Boston, Mass., has a booth strongly built of 8-inch high-pressure iron pipe and cast-iron fittings made up in the form of arches and enclosing a space in which is a complete line of valves and steam-pipe auxiliary brasswork.

MESSRS. GEORGE L. TYLER & CO., Boston, make an exhibit of gas and gasoline engines of the Hamilton type, one of which is in service running a Keystone dynamo, which is exhibited by the Hancock Equipment Company, of Boston. The dynamo is supplying current to a 3-hp motor of the same make.

THE JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., makes a small exhibit, which is a permanent fixture of the Mechanic Building, as it is a present to the association. It is a framed and glass-covered panel, showing samples of the various forms of wire and cable and insulations made by the company.

MR. JAMES L. RUSSELL, 170 Summer Street, Boston, the Eastern agent of the various houses mentioned below, makes an exhibit of the products of each. Among them are the instruments of the Syracuse Electrical Instrument Company, mounted on a switchboard built by the Shawmut Fuse Wire Company, and in circuit with a dynamo made by the Onondaga Dynamo Company, with enclosed arc lamps made by the Nowotny Electric Company, Cincinnati. The Philbrick mast arm is also sold by Mr. Russell. (See illustration).

THE AUTOMOBILE CARRIAGE EXHIBITS, which the exhibition management hoped would be a strong feature of the fair, were a notable failure; that is, in point of numbers. At the time of the writer's visit there were only two makes of electrical carriages—one, that of the Pope Manufacturing Company, of which two styles were shown, a fuller description of which will appear later in these columns, and the other, that of the Riker Electric Motor Company, of which only a tricycle was on view. There will be more vehicles from this company exhibited later. Beside the electric carriages there is but one make of gasoline carriage, that of the American Motor Company, 32 Broadway, New York, although several gasoline engines made for vehicle service are separately shown.

MESSRS. BLODGETT BROTHERS & CO., 301 Congress Street, Boston, show their electric self-winding clocks and time-dial service. The winding is done with any good open-circuit battery and a small motor with three horseshoe field magnets, soft iron segments in the armature and a commutator that switches on one or another of the magnets. The time-dial service equipment consists of one master clock, with a make-and-break device, closing a circuit through the actuating magnets of the various time dials at predetermined intervals, the escapement of the time dials being of a very positive character. A large four-faced clock, which appears in the foreground of the accompanying view of the Edison exhibit, is also the work of Blodgett Brothers & Co., as are all the main clocks in the building.

THE DEANE STEAM PUMP COMPANY, Holyoke, Mass., shows pumps in great number and great variety, a few of those interesting to central station men being as follows: A duplex outside-packed plunger double-acting steam pump for high-pressure boiler feeding; a combined receiver and pump on one base for taking drips of condensation, etc., and returning them under high pressure; a combined jet condenser and pump, and some "babies" which are now coming into use even in small central stations for pumping oil for automatic oiling devices. A so-called "sinker" pump for boiler feeding in locations where floor space is valuable is made by the Deane Company in considerable numbers and shown in this exhibit in a size which pumps 65 gallons per minute, but does not seem to have found its way into the central station field as yet, although it should prove valuable in many instances. That shown is built extra heavy, sufficiently so for feeding against any commercial boiler pressures, and occupies but 23x27 inches of floor space, being 9 feet high, with outside-packed, double-acting pistons. The exhibit is in charge of Mr. F. H. Hayes, the New England manager of the company. (See illustration).

MESSRS. WHITMAN & COUCH, Boston, make an exhibit as complete as though it were in an international electrical or telephone exhibition. With all the telephone instruments shown the receivers are, of course, of the new bipolar type, with suspension at the head end to do away with gap adjustment by expansion or contraction. Another thing which attracts considerable attention is the iron-box telephone for police or fire patrol or electric railway line station service. This box, which is only 7½x10½x17½ inches in external dimensions, and weighs but 65 pounds, contains a microphone transmitter with two cells of dry battery, induction coil, magneto generator, ringer and receiver, with a weight which pulls the cord in when the receiver is in place. The box is fitted with a contact which cuts it out of the line when the door is closed. On one side of the exhibit booth Whitman & Couch display a large number of samples of their wall apparatus. Among other things noticeable is a hotel and school telephone system, with an ordinary annunciator for ringing up and a panel of double-pole spring jacks for plugging in. The system is operated on the common-battery principle, three wires running to each station. The annunciator drops are reset by pressing a push-button, except the drops on those lines which are plugged in. Another thing that is new even to many visitors posted in telephone matters is the Whitman & Couch intercommunicating system, the instruments of which are so wired that when the receiver is hung up the bell continues to ring until the switch is restored to its normal position. A Mason automatic pay station is also shown with the door open for inspecting the parts. Desk sets, switchboards, plug boards, with the new removable front for wiring up, and many other forms of apparatus are also on view, and a large amount of it is in service on lines running to many parts of the building and centering in the Whitman & Couch booth. (See illustration).

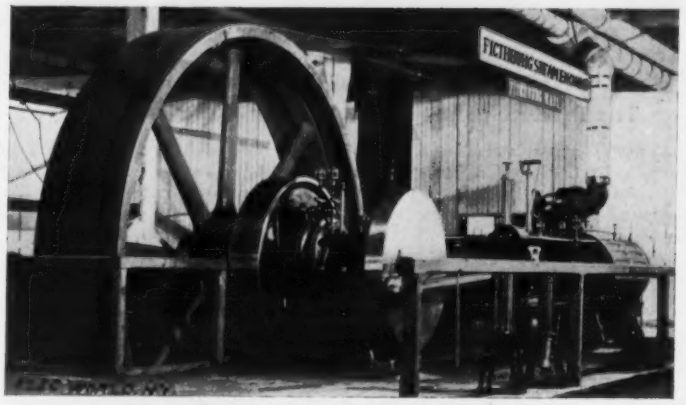
THE SPRINGFIELD ENGINE STOP COMPANY, Springfield, Mass., will install a Columbia electric engine stop upon the larger Fitchburg engine, but it has not been attached as yet. This is similar to the Corliss electric engine stop, which has been previously described in these columns, the mechanism being started by means of push-buttons or automatic contacts at any point from which it may be desired to stop the engine, a magnetically controlled valve admitting steam behind a piston, which in the case of Corliss engines throws the trip-toes to the zero-cut-off position, but in the case of other forms of engines closes the main stop valve.

THE FITCHBURG STEAM ENGINE COMPANY, Fitchburg, Mass., has two engines in the hall, doing useful service mechanically as well as displaying their good points. The larger is a single cylinder horizontal, 18x36, rated at 150 horse-power, running at 90 r. p. m., and belted to a countershaft, to which are also belted some large General Electric lighting generators. A smaller engine of the same type is also in service, directly belted to a generator. The engines are fitted with the now well-known cam wrist-plate motion and shaft governor, giving very quick action to the steam valves and an independently driven exhaust. A still sharper admission and exhaust is obtained by double-ported piston steam valves, and these valves are slightly unbalanced in the direction of their travel by the steam pressure acting on the area of the stem, holding them tightly against one side of the cam, giving a most beautifully noiseless running. A neat attachment unusual in engines with positive cut-off is a hand gear for manually operating the steam valves in starting and stopping. Another device insuring added comfort to the engineer is the set of bronze gibs on the crosshead. Mr. Fred Fosdick makes good use of the exhibit to point out the merits of the engine. (See illustration).

THE RIDGWAY DYNAMO & ENGINE COMPANY, successor to the J. H. McEwen Manufacturing Company, Ridgeway, Pa., makes a most useful exhibit, under the charge of Mr. J. L. Kimball, 63 State Street, Boston, the New England agent. The exhibit consists of a 75-kw Thompson-Ryan machine generating 125 volts at 260 r. p. m., mounted directly on the shaft of a McEwen 14x14½ high-speed engine. The latter is fitted with a modification of the Rites inertia governor, and the dynamo shows some recent modifications, the series winding being now a plain spiral of ribbon wound into slots between the four teeth of which every pole is composed. The flanges of the field yoke which formerly covered the field coils have also been abandoned. The series spiral is offset one-half pole angle from the shunt winding, thus exactly balancing the distorting effect of the same current in the armature. The machine is also fitted with a modification of the reaction brush holder, differing somewhat from that customarily used, the face of the holder against which the brush slides being almost radial, and the direction of rotation being such as to force the carbon brush against this surface instead of the contrary, as is customary. The machine is wired to a switchboard built by the Albert & J. M. Anderson Manufacturing Company, fitted with Keystone instruments, and carries a large electrical sign on the roof of the building at night and considerable of a day load. (See illustration).

THE JANDUS ELECTRIC COMPANY AND THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, make a combined exhibit under the supervision of Mr. H. T. Edgar, the New England manager for both companies, with offices in the Tremont Building. The Jandus Company shows seven complete arcs, both in the standard and short lengths, with various styles of globes and cases and the latest improvements in the controlling mechanism. The latter consists of a plain series solenoid concentric with the carbon, the spool serving also as a dashpot for the plunger, which is its own piston. This carries the well-known clutch, consisting of four knurled rings which grip the carbon. The 220-volt lamp is now made up in a different form, the control mechanism consisting of two solenoids diametrically opposite each other in the shell and two dashpots at the other two sides of the square, making a shorter lamp. This lamp is shown in operation, taking two and a half amperes and drawing an arc seven-eighths of an inch in length. In the centre of the exhibit there appears a handsome oxidized-silver frame, which attracts considerable attention, and the exhibit is yet to be completed by the addition of alternating-current enclosed arcs. The Buckeye incandescent lamps make a splendid showing on a large lamp board at the back of the exhibit, and also in the candelabra form, tipping the branches of the antlers of one of the most perfect bucks' heads that the writer has ever seen. In the line of new things a 220-volt lamp is shown with four anchors, two fastening in the sides of the bulb. Many decorative and colored lamps are shown, with beautifully clear translucent glass. The filament of the lamps is a special point of pride with Mr. H. C. Estabrook, who is in charge of the combined exhibit. It is made of a cellulous material derived from corn pith, and with a final exhaustion and treatment in a naphtha compound the completed filament shows a polished steel metallic finish that is the envy of others working in the same line. It is also flexible, but does not sag. (See illustration).

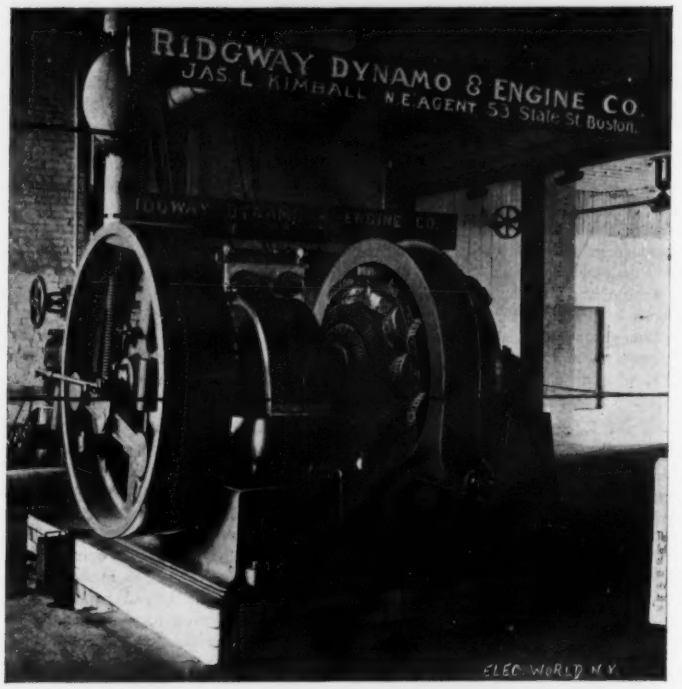
THE EDISON ELECTRIC ILLUMINATING COMPANY, of Boston, makes a most elaborate exhibit and follows the custom set by its associates in New York and Chicago in constructing a booth of a pleasingly artistic architectural design, and filling it with electrical apparatus of a most instructive character. The exhibit of the Boston Edison Company covers a space 42x52 feet, and is housed by an open structure of columns and beams built after the design of a Roman vinery, painted to imitate marble and frequently re-covered with fresh Alabama smilax. The structure is divided into two sections joined by an arch, and is lighted by some 4000 incandescent lamps, all frosted. Around the outside (see the accompanying illustration) are electrical signs made up of 1-cp lamps; in the archway are many designs of 3-cp lamps and all the others used in the illumination are of 24 candle power. One of the two main divisions is devoted to exhibits of electrical applications of power and arc lighting apparatus, the other to electrical heating, cooking and incandescent lighting. One of the novelties shown is a model of an electrical hydrant intended for motor-carriage service, consisting of a column carrying a heavy cast-iron box, with a door to which electric carriage owners may be provided with keys. Within the box is a prepayment meter, which, when the proper coin has been inserted, will give a charging connection. A flexible cord is provided to attach the carriage to the box. The most elaborate and to the visitors of the fair most instructive part of the whole exhibit is the complete line of electric heating



The Larger Fitchburg Engine.

Telephone Apparatus by Whitman & Couch.

Exhibit of Deane Steam Pumps.



Thompson-Ryan Dynamo and McEwen Engine.

Apparatus Shown by James L. Russell.

The Jandus and Buckeye Exhibits.

[See Page 454.]

and cooking apparatus which is exhibited by the American Electric Heating Corporation, of Cambridgeport, Mass. A description of this apparatus will be found in separate note. The exhibit contains also a full line of Jandus enclosed arcs, a complete line of instruments, including a mammoth 8000-ampere astatic Thomson integrating wattmeter in operation, a Wright demand-meter and a G. E. prepayment or coin-in-the-slot meter. Another Thomson recording wattmeter is shown in operation with a lamp load to prove to the uninitiated a fact concerning which they are rather skeptical, namely, that the meter does stop when the current is turned off. Of the large line of apparatus for making use of electric power there is room here for but a brief list. Among other things are a Sprague push-button elevator for house service; a Burton liquid forge; a Worthington house pump, with a Zimdars & Hunt float switch; a Davidson direct-coupled fan; an Elektron dumbwaiter; a Zeigler stage lamp and X-ray coil; a Lundell summer and winter fan; a job press driven by the friction of the motor pulley on the fly-wheel, with a pedal for throwing off this friction and throwing on a brake, or vice-versa; a Stow flexible shaft outfit with emery wheels, wood bits, etc., and a Singer sewing machine and Diehl motor. The company's methods of distributing current are illustrated by a full-sized junction box; the operation of a complete photometer is shown, and diagrams of the growth of the business and of the relative business done in Boston and in other cities are mounted about the booth. On the latter point valuable data have been secured by an extended line of correspondence carried on by General Manager Edgar, showing some interesting results. For example, the number of incandescent lamps installed per thousand people is larger in Boston than in any other large city, being 1232. The number in New York per thousand of population is 859, and in Chicago 730. This is shown graphically by a representation of the solar system, Boston being the hub or centre, and the other cities revolving around it, the diameters of the various planets and of the sun being proportional to the number of lights per thousand. Other diagrams show the growth of the business. The horse-power actually furnished is given as 200 for 1887 and 6708 for 1898. The number of electric elevators has grown since the year 1890 from 69 to 401, the rated horse-power of such motors increasing in the same time from 689 to 4475. The increase in the number of incandescent lamps wired from 1886 to the present time is from 4847 to 166,376, the number of the company's customers at the same times being 50 and 5167. Other interesting details almost too numerous to mention are shown, a novel one being the projection of an arc on a large scale on a screen. The arc is a long flaming one, being an enclosed arc lamp with the enclosing globe removed, giving the colors of the different parts of the flame most beautifully. The exhibit is in charge of Mr. La Rue Vredenburgh, who must be credited with having prepared one of the most valuable electrical exhibits to the public in general ever shown.

THE HOLTZER-CABOT ELECTRIC COMPANY naturally makes an extensive exhibit in a fair located in the same city as are its home offices and factory. The well-known line of Holtzer-Cabot apparatus is fully covered by samples. A few of the more recent novelties are as follows: The Ness automatic telephone switch for intercommunicating systems attracts some attention, its chief distinguishing point being that the moment the receiver is hung up the switch is released and is instantly spring-restored to the proper normal position. With all telephone apparatus shown the Holtzer-Cabot metal cap receiver is, of course, used. Another novelty is a direct-geared motor-driven bandage winder for hospitals, with a spring drive designed to slip in case the bandage becomes caught. It is fitted with flanges to take bandages of any width up to 8 inches. The Holtzer-Cabot Company is also making a motor with shaft extensions, especially fitted to take standard dental laboratory tools. Another ingenious device is shown in the new gas-engine igniter, consisting of a small bipolar magneto generator to be belt-driven from the engine, with the ordinary sparking coil, the armature and commutator of the generator being enclosed and dustproof. This sort of igniter will certainly give much less trouble than a primary battery, a slight compensating disadvantage being the fact that the igniter requires a battery for use in starting the engine, although with this limited use a good open-circuit battery should last indefinitely.

The Product of the Pittsburg Transformer Company.

A new concern, the Pittsburg Transformer Company, Pittsburg, Pa., has entered the field as a manufacturer of transformers, and has started the construction of a line known as Type "K," and shown in the accompanying illustrations. The new transformer is of the core type, with the windings on the two long sides of the rectangle, this type having the advantage that the coils are readily replaceable in case of trouble without separately withdrawing and replacing every lamination of the core. All iron is of rectangular cross section, and by slipping out the short sections joining the tops of the long cores the coils may be readily slipped off. Their insulation is not as liable to be cut in simply slipping them onto a core already built up, as is the case with transformers of the shell type.

HOLTZER-CABOT APPARATUS.

The details of construction embody considerable study and are of no little interest. The low-tension coil is wound nearest the iron, and is separated from the high-tension coil, which is wound over it, by a micanite plate. The long coils of the primary and secondary in close juxtaposition for the whole length gives a small magnetic leakage. The primary is wound a little shorter than the mould, giving a chance to bend over the ends of the micanite plate, and also fold over the sheets of rolled paper that are wound between the layers of the primary, giving a high insulation and long creeping distance between layers, and particularly between the ends of the layers, which are the weakest points in core-type transformers. The secondary is made up of rectangular strip multipled in all but the small sizes. The combined coils are heavily wrapped with pressboard tape and slipped onto the core between fibre end plates. The terminals of primary and secondary are respectively brought out on opposite sides of the transformer to a terminal plate, where they are soldered

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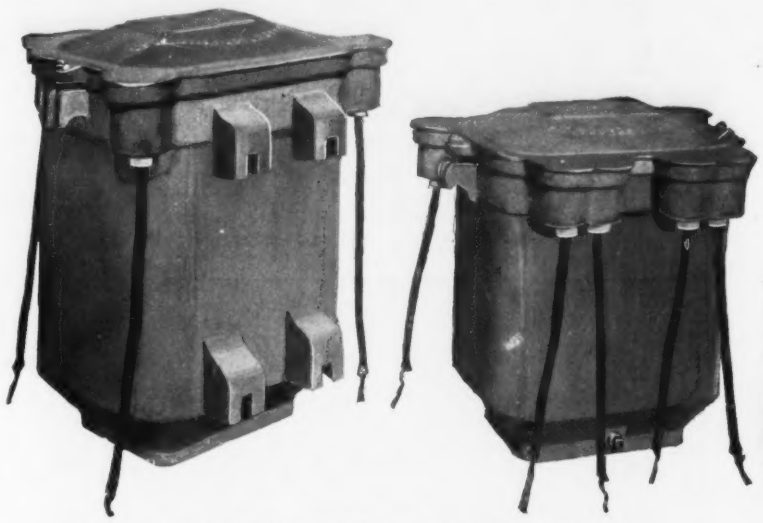
EXHIBIT OF THE BOSTON EDISON COMPANY.

to the leads which pass out downwardly through porcelain bushings, four leads being taken out from the secondary to get the proper series and multiple connection outside of the transformer case. The transformers with oil are tested between copper and iron and copper and copper, with a pressure of 10,000 volts. The case is of cast iron japanned to render it mineral-oil tight, the transformer being designed for either oil or dry insulation. It is fitted with slotted lugs, which can be slipped over bolt heads to fasten it in place, yet leaving it readily removable.

The transformer is carefully designed for low iron loss, which the company's tests show to vary from 2.2 per cent. on the 1-kw to 1 per cent. on the 5-kw size; also for close regulation, which on inductive loads varies between 2½ per cent. and 2 per cent. on the same sizes, respectively, and for low temperature rise and consequently considerable overload capacity.

The company also puts out for the protection of the transformer an all-porcelain single-pole primary fused terminal.



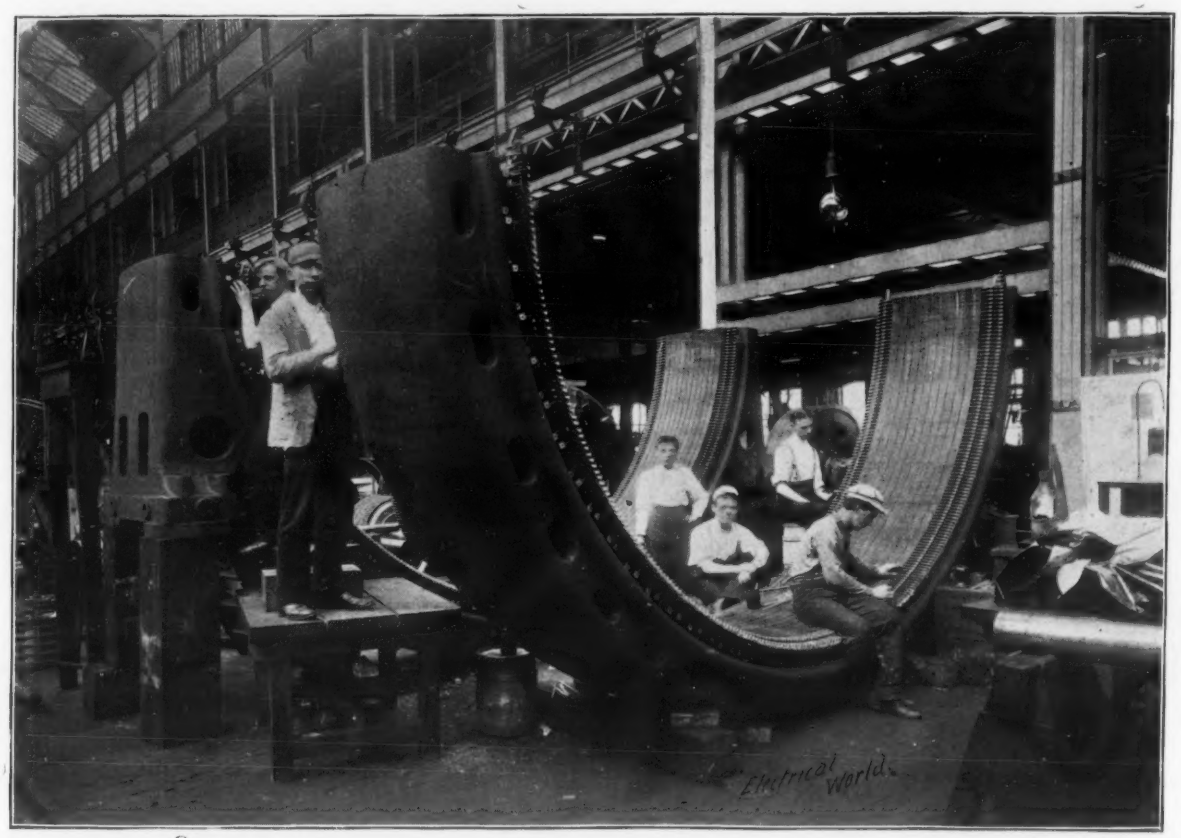
REAR AND FRONT VIEWS OF TYPE "K" TRANSFORMERS.

COMPONENT PARTS OF THE TRANSFORMER.

The Visit of the Knights-Templar to the Westinghouse Works.

On Wednesday and Thursday, October 12 and 13, the members attending the Knights Templar conclave at Pittsburg visited East Pittsburg, where those attending were granted the fullest opportunities of inspecting the works of the Westinghouse Machine Company and the Westinghouse Electric & Manufacturing Company. In the former two of the large steam engines for the Metropolitan Electric Supply Company, of London, were assembled for tests. Westinghouse gas engines of all sizes were shown under construction. Gas engines were also shown under test, one engine coupled to a dynamo being intermittently loaded to show the perfection of the speed regulation. In the electrical works the Knights were shown through the main aisle of the long shop, where there were in various stages of construction the parts of generating machinery aggregating in capacity an output of about 50,000 horse-power. A large part of this was alternating apparatus, and among the largest machines were the following: A 5000-hp dynamo for the St. Lawrence River water power plant, a 2000-hp alternator for the Metropolitan Electric Supply Company, of London; four 1500-kw generators for the Snoqualmie Falls plant, a 850-kw generator for the People's Light & Power Company, of Newark; a 750-kw dynamo for the United Electric Light & Power Company, of New York, and four 750-kw generators for the Kings County Electric Light Company, of Brooklyn. Besides these there were many direct-current machines and a number of induction motors of 300 horse-power and smaller sizes, and rotary transformers of 500-kw capacity.

One of the most interesting types of machines was the 850-kw rotating-field alternator for the plant in Newark, parts of which are shown in the accompanying illustrations. This machine is designed to be direct driven by an engine at 90 revolutions, and has 80 poles, the diameter at the air gap being 168



THE STATIONARY ARMATURE OF THE NEWARK ALTERNATOR.

inches, the machine delivering two-phase current at a normal pressure of 2300 volts, with a frequency of sixty cycles per second. The machine is, however, so wound that it will give with full non-inductive load a terminal pressure higher by 300 volts, and will also stand a current output 60 per cent. above the rating for several hours. Both armature and field are bar wound, the field windings being laid up edgewise, the field coils being noticeable for their shortness. The armature winding differs from the customary continuous single winding of the Westinghouse Company, having two independent distributed lap windings, one for each phase, with three slots per hole per phase, the independent groups of three laps each being connected in series with adjacent groups, there being but two paths in the whole winding of either phase. The ampere turns of the armature are small compared with those of the field, there being but two bars per slot. This gives the armature low self-induction and low reaction under inductive loads, and gives good regulation on motor loads with low power factor. A considerable air gap and an unsaturated magnetic circuit are used for the same purpose.

A Private Plant Telephone System.

Within the last few years there has been remarkable progress in the adoption of telephone systems for private plant use. In plants of this character the central station system has always been considered impractical where the service

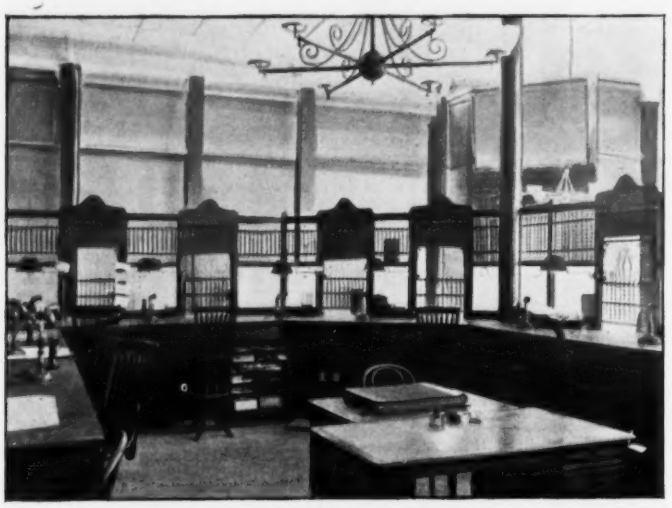


Fig. 1.—Telephones in Application Office.

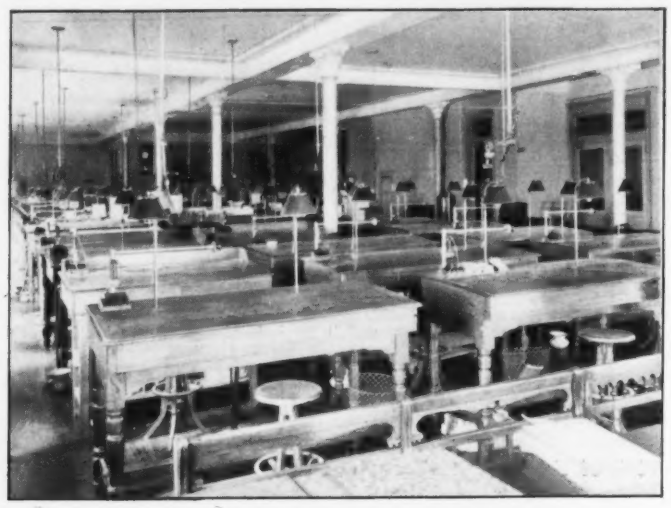


Fig. 3.—Bookkeeping Department.

was not sufficiently voluminous to require the constant attendance of an operator, owing to the time required for an irregular attendant to make a desired connection.

To avoid this delay in small plants many devices have been evolved, from an ordinary strap switch to a complicated automatic switchboard. One of the most thoroughly practical and reliable systems is the intercommunicating system

Fig. 2.—Portable Desk Set and Plug Switch.

placed on the market some time ago by the Stromberg-Carlson Telephone Manufacturing Company, Chicago. A large and convenient plant of this kind has recently been installed by that company for the People's Gas Light & Coke Company, of Chicago. It consists of nearly 100 instruments, connecting the application offices on the main floor with the bookkeeping department on the second floor, and the officials and heads of departments on the third, fourth and fifth floors and the basement.

Fig. 1 is an interior view of one of the application offices, showing six private plant instruments and three telephones connected with the public exchange. Each office on the main floor is furnished with an instrument consisting of a portable desk set and a sixty-point plug switch, shown in greater detail in Fig. 2.

The desk set is neatly designed and very substantially constructed. The plug switch consists of a series of jacks compactly mounted, to which the direct lines from the instruments in the bookkeepers' department are connected. Each desk in this department (Fig. 3) is furnished with a long swinging arm telephone and a plug switch connected direct with each instrument on the main floor.

In this system the user is not required to first call an operator at a central office, but completes the calling circuit to the station desired by inserting the plug in the corresponding jack, regardless of where the plug of the called instrument may be. The talking circuit is completed by the person called placing the plug in the home number. Should a user neglect to disconnect an instrument when through, or fail to place the plug in the home station jack, it does not prevent that station from being called by another station, as is the case in ordinary strap switch systems. Any number of pairs of instruments may be used simultaneously without interference. The objectionable cross-talk, so frequent in systems of this kind, is entirely avoided by the peculiar arrangements of circuits.

Fig. 4 shows a pedestal, near the president's desk, with a desk telephone and plug switch for the office system and a telephone connected with the public exchange. These pedestals were furnished with the private system, and were specially made to accommodate the public exchange telephone as well as the private plant instrument. The instruments are of the regular long-distance type,

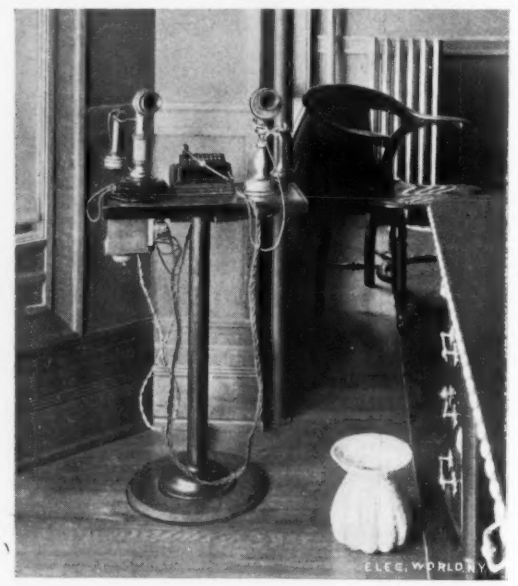


Fig. 4.—Pedestal.

and in cities where independent public exchanges have been established the private system is connected directly with the public exchange, and the separate instrument is not required.

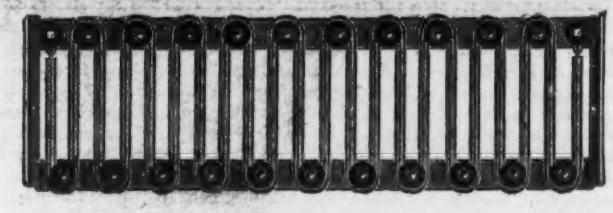
This system is said to be used in many of the largest business houses in the principal cities throughout the United States, and is being installed in many large residences, hotels, public institutions, factories, and for connecting mines, mills and offices. It is claimed to have been most carefully worked out in all its detail, and when once properly installed to require but very little attention for many years.

Electric Car Heaters.

The accompanying illustration shows the heating coil used in the car heaters manufactured by the American Electric Heating Corporation, Cambridgeport, Mass.

The heaters are made in seven different sizes and forms. The cases are of cast iron, and while very strong in form are light of weight. The heater consists of two coils of special non-corrosive wire in the form of open-coiled

springs. These coils have a stout asbestos cord running through their centre from end to end. An oblong frame of flat steel, provided with suitable pins projecting from either side, furnishes suitable supports for round-grooved porcelains on which the coils are mounted. The asbestos cords are drawn taut and fastened on their respective sides to the terminal porcelains at either end, to which also the coils are made secured independently. The asbestos cord furnishes a continuous support throughout the length of the coils, prevents the possibility of the coil in any manner getting out of place and permits the coil to be put in place and maintained there without tension on the same.



HEATING COIL.

Rubber covered flexible terminal conductors are connected to the coils by good mechanical joints and soldered, the flexible conductors passing through porcelain-bushed holes to the outside of the case. All heaters in a car are designed to be connected in series in two circuits.

The company states that the present types of American heaters have been in continuous service for five years, and have demonstrated that they may be maintained with absolutely no cost for repairs, being practically indestructible.

A Portable Electric Safety Lamp.

There has recently been devised a portable electric safety lamp for use in special cases when an open flame or even one safeguarded, as in the miner's lamp, would prove dangerous. The combination consists of a dry battery arranged to be carried in a holder at the belt, or in the pocket. The battery is controlled by a small rheostat, maintaining an even supply of current to the lamp and allowing it to burn with the same brilliancy during the life of the battery. The electric lamp, connected to the battery by a flexible cord, is the miner's lamp, manufactured at the Edison Lamp Works of the General Electric Company. It is of six candle power, and is set in a small white enamelled parabolic reflector, provided with a stick pin to allow it to be attached to the hat or any part of the clothing. The light is strong enough to allow ordinary printed matter to be read at a distance of 100 feet from the lamp.

THE LAMP.

The combination is manufactured by Elmer E. McIntyre, of Pittsburg, Pa., and has been found very useful by gas inspectors in reading meters in dark cellars; by repair men exploring cellars and trenches for gas leaks and defective pipe connections or examining

ELECTRIC SAFETY LAMP LIGHTED.

gaseous sewers; by miners and mine inspectors in gaseous mines, where the risk of explosion even from the miner's lamp is ever present; by watchmen in powder mills and warehouses storing inflammable oils and essences or by workmen repairing oil and gas tanks or examining the riveting inside steam boilers. This lamp is especially valuable, as it leaves the hands free. Its weight is about 2 pounds.

Magnetic Lamp Holder.

A unique incandescent lamp holder is shown in the accompanying illustration, the figure at the left being the holder and that at the right showing the lamp and holder combined. Within the holder is an electromagnet, the poles of which are in the shape of two bars, of rectangular section, set parallel to each other, as illustrated. When the lamp is burning, the magnet coils being connected in series with the filament, the holder is energized, and the resulting magnetic lines of force emanating from the poles afford a means of attaching the lamp to any body of iron or steel. It is obvious that this device will find many uses in such places as machine shops, where it is frequently desired to move a lamp quickly from place to place around lathes and drills, for instance.

MAGNETIC LAMP HOLDER AND ITS APPLICATION.

The lamp and holder will fasten itself to any mass of iron or steel instantly, and will remain in any position.

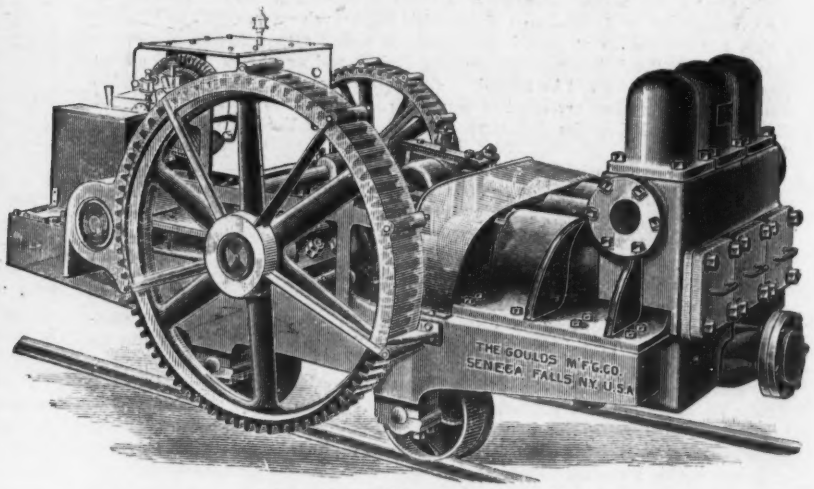
This device will be particularly useful in engine and boiler rooms, in making repairs on elevators, in boiler shops, etc. It is entirely portable, and is made for Edison, Westinghouse and Thomson-Houston lamps.

Messrs. Jenkins Brothers, 71 John Street, New York, are the sales agents for this novel device.

A Triplex Electric Mine Pump.

The flexibility and convenience of electric power application are well illustrated in the apparatus represented in the accompanying cut. This machine was built by the Goulds Manufacturing Company, Seneca Falls, N. Y., for "The William A" colliery of the Connell Coal Company, at Lackawanna, Pa. The armature of the motor is connected with the pump through double-reduction gears, the upper half of the gears being protected by shields. The motor is ironclad and enclosed in such a manner as to render it waterproof.

The triplex electric mine pump, as built by the Goulds Company, requires but occasional attention for oiling, and pumps at a uniform rate under all conditions, and it is impossible for it to "run away" when the water is pumped out. That electric pumping has become permanently identified with mining is evident from the rapidly extending use of apparatus of this kind. In this particular case the pump is used to pump water from the mine drift back to the base of the mine shaft. This pump is especially adapted for going into shallow cuts, which is a necessity in a mine pump of this kind, and the entire outfit is easily moved from place to place. With the pump and motor a float is placed in the pump, which automatically controls the operation of the motor. When the water falls below a certain level the current is cut off and the motor stops, and when it rises the circuit is closed and the machine again starts up.



MINE PUMP DRIVEN ELECTRICALLY.

NEWS OF THE WEEK

Financial Intelligence.

DIVIDEND.—The directors of the Edison Electric Illuminating Company of Boston have declared a regular quarterly dividend of 2 per cent., payable November 1.

THE CHICAGO EDISON COMPANY reports an increase in gross earnings for the six months ended September 30 of 20 per cent., and an increase in net earnings over fixed charges from 11 to 12 per cent. The net earnings do not keep pace with the gross earnings, owing, it is explained, to the policy of the company of reducing the average price per electrical unit to consumers.

THE EDISON ELECTRIC ILLUMINATING COMPANY OF NEW YORK reports gross earnings during the month of September of $230,123.78, an increase over September, 1897, of $47,936.71; net earnings $88,925.62, an increase of $20,042. The gross earnings for the nine months ended September were $2,170,763.50, an increase of $427,008.98 over the corresponding period last year. Net earnings $908,377.75, an increase of $142,522,52.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
9 Murray St., NEW YORK October 24, 1898

A THEATRE PARTY, including many well-known members of the New York electrical fraternity, accompanied by their lady friends, will listen to the opera of "The Fortune Teller" at Wallack's Theatre on Tuesday evening next, and afterward enjoy supper together in one of the handsome dining rooms of the Waldorf-Astoria.

MR. MAXIM AGAIN FREE.—The charges of bigamy and abandonment brought against Mr. Hiram S. Maxim by a woman calling herself Helen Maxim, to which case reference was made in the last issue of THE ELECTRICAL WORLD, have been formally dismissed at Poughkeepsie, N. Y. Mr. Maxim was discharged and released from bail.

AT A MEETING of the directors of the Western Union Telegraph Company, held in this city last Wednesday, Mr. Thomas F. Clark was elected to the office of vice-president and as a director of the company. Mr. Myron T. Wilbur was elected treasurer to fill the vacancy occasioned by the death of R. H. Rochester. Mr. Clark takes the place in the directorate made vacant by the death of Mr. J. W. Clendenin, and was acting vice-president prior to his election.

ELECTRIC HEATERS IN SHOW WINDOWS.—A popular form of advertising is the display of goods in store windows, and anything that obscures the view from the sidewalk necessarily impairs the efficacy of such displays. In the winter time, for instance, the air within the store frequently condenses upon the cold window glass and obstructs the view from the outside, unless some precautions are taken to prevent such a result. One of the most convenient ways to avoid condensation is to use an electric heater in show windows. This can be easily done because most all stores use electric light, and the current is on tap. Here is a suggestion for enterprising storekeepers who are bothered in the winter time with "sweating" windows. The remedy is simple, as electric heaters are now marketable commodities.

MEETING OF THE NEW YORK ELECTRICAL SOCIETY.—The 190th meeting of the society will be held at the Pearl Street sub-station of the Edison Electric Illuminating Company of Brooklyn, at 7:30 P. M., Thursday, October 27. Mr. W. S. Barstow, chief engineer, will make an address on the company's work, after which a brief inspection of the station will be made. The rest of the evening will be devoted to a flying visit to the sub-station "A" and to the Union central station at Bay Ridge. Special parlor cars will take the members from the Pearl Street station to Bay Ridge, and on the return trip from Bay Ridge a collation will be served on the trolley cars. The Brooklyn Heights Railroad Company has arranged to run the parlor cars to the New York end of the Brooklyn Bridge for the convenience of the New York members on their return home.

AT A RECENT MEETING of the directors of the Brooklyn Elevated Railroad Company it was decided to instruct the counsel of the company to begin immediate proceedings before the Supreme Court for the discharge of the receiver now in charge of the property, and place the road on a solvent basis. The reorganization of the road is now practically accomplished, and at the expiration of the regular thirty days' notice the bill of sale of the road will be made out and the property will be sold by the sheriff at public auction. A purchasing committee was appointed by the directors to buy the property for the reorganization committee. President Uhlmann expects that the reorganization will be completed and the new company launched into existence about November 15. The new company will be known as the Brooklyn Union Elevated Railroad Company. The directors at the same meeting discussed the plan of changing the motive power of the road from steam to electricity, and ordered the chief engineer, Mr. George B. Cornell, to immediately obtain estimates of the cost of so equipping the road.

THE ELECTRIC LIGHTING COMPETITION.—To meet the low rates made by the Edison Company on electric current for light and power purposes noticed in these notes in THE ELECTRICAL WORLD of October 8, 1898, the United Electric Light & Power Company has issued a new schedule of reduced rates applying to bills for current supplied after October 1, the charges being as follows: For retail incandescent and arc lighting the maximum charge is 15 cents per kilowatt hour for 1, 2 or 3 hours' average daily use of the total number of lamps installed; and 5 cents per kilowatt hour for all use in excess of three hours' average daily use. For larger loads with a consumption of 2000-kw hours or over each month and two hours' average daily use of all lamps connected the charges are 10 cents per kilowatt hour for the first three hours and 5 cents per kilowatt hour for all use in excess of three hours' average daily use. These rates include the incandescent lamp renewals and the arc lamp trimming. For power, a maximum charge is made of 12½ cents per kilowatt hour, with discounts running from 20 per cent. for a monthly consumption exceeding 100-kw hours to 50 per cent. for a consumption exceeding 1500-kw hours. For payment within ten days after the presentation of the bill a further discount of 5 per cent. is made on all bills of $500 or over and 10 per cent. on bills of $1000 or over. The advertisement of these rates concludes with the following statement, which puts the whole matter in a nutshell: "These prices are made to encourage the use of electricity for domestic lighting and power purposes to the exclusion of other methods."

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., October 21, 1898.

THE ELECTRIC PLANT at the Curtiss malt house at Black Rock is to be ready for use early next month. It is an innovation in this section, and the great malting interest will be anxious to know how it succeeds, though there seems to be no doubt of satisfactory work. Still Buffalo is so conservative that good things have to be thrust down the throats of the people before they will accept them.

THE FIFTH ELECTRIC GENERATOR is now in operation at the Niagara Falls tunnel power house, and appears to be doing good work. Of course, not all of the 25,000 horse-power now available is needed, but it is a wise policy of the management to keep well ahead of the needs of the business, and at least one generator will be retained for an emergency, though the machinery has now run so long without an accident of account that it ought to be established now that no difficulty is to arise on account of the mere novelty of the undertaking.

IT HAS BEEN FOUND that the feed wires for the Lockport trolley between Tonawanda and Lockport are not sufficiently well distributed over the line to properly feed the current, and more are to be put in. Under the present arrangement the current from Niagara is taken to the farther end of the line at Lockport, where at present the transformer station is located; then the modified current is sent back over the line and delivered at various points. A transformer station is building at Tonawanda, which will when finished meet the return feed wires half way and obviate the difficulty.

THE WORK of setting the new Buffalo lighting station in order proceeds slowly. A large room is to be filled with motors, each with generators attached, for the accommodation of small power customers, and after that the small room for the eleven transformers which are the property of the Cataract Power & Conduit Company. These are in position, but no connections have been made yet, and only about half the motors in the principal room are in place. With the small force at work on the plant there is no prospect of more than a small part of the station being ready for use right away.

THE KEY to the situation in Buffalo, so far as the rapid extension of electric power is concerned, is about to be turned in the appearance of the long-looked-for apparatus at the Urban flour mill. Work has begun, and everything, it is reported, will be completed and ready for operation by November 4. With this mill in operation by electric power there is promise of the other city flour mills falling into line, as all are waiting for it. The electric apparatus is to be installed without disturbing the steam plant, and it is even arranged so that the steam engine can be started up and run in connection with the electric power, if desired.

CHICAGO NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., October 21, 1898.

MR. SAMUEL INSULL, president of the Chicago Edison Company, gave a dinner at the Grand Pacific Hotel, Chicago, on Saturday evening, October 15, in honor of the returned employees of that company who volunteered for active service during the late war.

THE HARVARD ELECTRIC COMPANY, of this city, wishes to deny a report which has been circulated to the effect that a damage suit has been brought against it for manufacturing a line of telephone fuse links and blocks. It says there is nothing in the rumor.

THE CHARLES MUNSON BELTING COMPANY, of Chicago, has made an assignment without preference to the Chicago Title & Trust Company, of the same city, owing to a judgment recently entered against A. Groetzinger & Sons at Allegheny, Pa. The intimate business relations between that firm and the Charles Munson Belting Company made the assignment desirable for the purpose of protecting the interests of the business, which is going on as usual and filling orders in the regular course of trade and upon the ordinary terms of credit. The company says that the stock of belting and merchandise on hand and plant for sale is larger than usual, and that all orders will receive prompt attention. It is hoped that the necessity for the services of an assignee will be but temporary.

WASHINGTON NOTES.

WASHINGTON, D. C., October 22, 1898.

THE TELEPHONE CONTROVERSY AS UNDERSTOOD BY THE TREASURY DEPARTMENT.—The latest adversary to take issue with the Chesapeake & Potomac Telephone Company in the matter of its refusal to abide by the late law of Congress, fixing the maximum rate for the use of a telephone in the District at $50 per annum, is the United States Government through the Treasury Department. The matter was brought to the official notice of the Treasury by Public Printer Palmer, who inquired of the department whether the provision in the act of June 30, 1898, fixing the amounts which may be paid for the use of telephones in the District did not invalidate the contract entered into by him with the telephone company in August, 1897, for the installation in the printing office of a twenty-five-station switchboard. The reply to this inquiry by Comptroller Tracewell, of the Treasury Department, is emphatic and unequivocal. He declares that the "telephone company being a corporation is a creature of the law, is protected by the law and must obey the law. It must furnish both individuals and the Government the benefits of its telephone system, and do this under the rate of charges fixed by law or give way to others who will." In the special instance of the Government Printing Office the comptroller gave it as his opinion and so decided "that from and after the taking effect of the provision of the law of June 30, 1898, its effect was to abrogate the contract set out, for the prices therein fixed are in excess of those fixed by the law for the use or rental of a telephone." In view of this decision, it is understood that what applies to the Government Printing Office of course applies to all other departments of the Government. Should the telephone company refuse to abide by the Comptroller's decision with regard to Government contracts it is the intention of the department that the Attorney-General shall be requested to begin injunction proceedings, and it is confidently believed that the courts will sustain Comptroller Tracewell's views.

THE DISTRICT ELECTRIC COMPANIES QUARRELING OVER CONDUITS.—An interesting point of dispute between the United States Electric Lighting Company and the Potomac Electric Company, two rival corporations, has been settled, if the opinion of the attorney for the District is accepted as authority in the case. The cause of complaint was, as stated in a communication to the District Commissioners by Captain Thomas, president of the United States Company, that the Potomac Company was utilizing the conduits of the Postal Telegraph Company to run in a cable at Fourteenth and F Streets, and had connected up with the same. Captain Thomas stated that the Potomac people had no authority to make such a connection, and if they had he would be at perfect liberty to utilize the conduits of the Metropolitan Railroad Company to run his own cable down Four-and-a-Half Street. Upon investigation by the commissioners it was found that in one of the vaults under the sidewalk in the west side of Fourteenth Street the brick arch to the vault had been broken through and two cables brought through to the opening, apparently from the conduit of the Postal Telegraph Cable Company. These wires were traced through to the room containing electric motors which operated the elevator in the Wyatt Building. The matter was then referred to the attorney for the District by the commissioners. Upon inquiry by the attorney, the Potomac Company stated that in November, 1897, by reason of the fire in the plant of the United States Electric Lighting Company, the service of that company was for a time discontinued. This discontinuation seriously crippled the business of the Postal Telegraph Company, and in order to guard against a recurrence of this trouble the latter company made application to the Potomac Electric Power Company for connection with its lines, and was at that time only able to make connection through the conduits of the Postal Company by joining the two conduits at Fourteenth Street and New York Avenue. In his opinion, rendered to the District Commissioners, Attorney Thomas says that the Potomac Company claims that it is a joint owner of the conduit at Fourteenth Street. The attorney states that the cables in it were placed there with the knowledge of the commissioners. He asserts that there are two questions involved in the matter: First, whether the conduit on Fourteenth Street is legal, and, second, whether it was necessary for the Potomac Electric Power Company to have a permit from the commissioners to make the connection complained of. Attorney Thomas decided in favor of the company in the first question on the ground that Congress, in a clause in the efficiency bill of July 8, legalized all existing conduits within the fire limits, whether for electric lighting, telegraph or telephone service. In regard to the other question, Attorney Thomas says that the controversy is reduced to the point that the Potomac Company made the connection without a permit, but that if Congress had not legalized all the conduits the commissioners would have granted a permit for a house connection, and there is now no necessity for any action in the case by them.

ST. LOUIS NOTES.

ST. LOUIS, Mo., October 21, 1898.

NEW INCORPORATION.—The Joplin Illuminating Company, capital stock $80,000, was incorporated under the laws of Missouri last week. Among the leading stockholders are John C. Porter, Harrison L. Drummond, Charles Nelson, John S. Dunham and Francis Kuhn. The new corporation will manufacture gas and electricity.

THE LINDELL RAILWAY FRANCHISE.—The bill granting a franchise to the Lindell Railway Company, and allowing it a large number of valuable concessions, and which passed the upper house of the City Council a few days ago, was passed by the lower branch this week, and is now awaiting the mayor's signature. Property holders along the various lines are making a big fight on it.

UNDERGROUND WIRES IN ST. LOUIS.—The stockholders of the National Subway Company, of St. Louis, will meet on November 5 to vote on a proposition to increase the capital stock of the company from $250,000 to $2,000,000. The law compelling electric companies to place their wires under ground in that city has greatly increased the value of the company's property and franchise, and necessitated an increase in its capital.

COUNTY RAILROAD AND TELEGRAPH TAXES.—The following abstract of taxes levied against railroads and telegraph companies in St. Louis County was submitted by the county clerk and approved by the County Court last week and charged against the county collector; Clayton & Forest Park Railroad, $281.94; Midland Electric Railway, $540.78; St. Louis & Suburban Railway, $2,551.21; St. Louis & Meramec River Railroad, $1,336.34; St. Louis & Kirkwood Railroad, $1,443.93; Southern Electric Railroad, $1,116.11; St. Louis County Street Railroad, $110.95; Western Union Telegraph, $520.70, and Pacific Mutual Telegraph, $85.08.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., October 17, 1898.

THE GRIFFITH MINE, located in the State of California, will soon be electrically equipped with Westinghouse motors and other apparatus.

MR. A. O. SCHOONMAKER, of New York, is now represented on the Pacific Coast by the Electric Railway Manufactures & Supply Company, 548 Mission Street, San Francisco. This company will carry a full stock of Mr. Schoonmaker's mica, cut and uncut, segments and rings, for prompt delivery.

THE OAKLAND MESSENGER, BURGLAR & FIRE ALARM COMPANY, of Oakland, Cal., was recently incorporated with a capitalization of $20,000; actually subscribed, $6000. Among the company's objects are to build and operate telephone and telegraph lines, conduct a general messenger business, etc. The directors named are Albert Aucker, Henry H. Beck, Frederick Kahn, Philip Marx and Edward I. Wolf.

THE SUNSET TELEPHONE COMPANY now has in successful operation its through line from San Francisco to Portland, Ore. On October 17 at the invitation of Assistant General Manager Louis Glass, a number of San Francisco business men tested the capabilities of the line and listened to the exchange of compliments which took place over the wire between Mayor Phelan, of this city, and Mayor Wood, of Portland. A quarter-minute conversation between San Francisco and Portland, Ore., or Tacoma, Wash., cost 75 cents.

ELECTRIC POWER FOR FARMERS.—A movement is on foot to have a pole line extended along the Sacramento River from the Sacramento Gas & Electric Railway Company's Folsom power station for the accommodation of farmers and others who wish to use electricity to operate pumps. The pumps will be used for reclamation of the low lands along the river and for irrigation purposes. An electric railway project is also being talked of in the same connection. A company may be organized in order to work on a large scale and buy current at cheap rates.

CANADIAN NOTES.

OTTAWA, ONT., October 21, 1898.

THE CITY COUNCIL of Hull, Quebec, has decided to ask for tenders for lighting the city by arc lights. The tenderers will be asked to quote for the whole electric plant, the city to have the right to purchase within five years.

THE TORONTO STREET RAILWAY COMPANY is said to be considering the advisability of extending the Toronto & Scarboro Railway from the present terminus, at the Hunt Club, to the west side of the Highland Creek hill, a distance of 7 miles. A survey of the proposed route has already been made.

THE SHAREHOLDERS of the Montmorency Electric Power Company, of Quebec, have ratified the action of their directors in selling the property of the company to the Quebec, Montmorency & Charlevoix Railway Company. The shareholders of the former company not only receive for each $100 share of their stock in that company a share of an equal amount in the latter, but also a twenty-year debenture of $100 bearing interest at 5 per cent. per annum.

THE METROPOLITAN ELECTRIC COMPANY, of Ottawa, has purchased the immense Britannia water power, at Britannia, in the suburbs of this city. The deal was completed last week, and the amount involved is understood to be over $20,000. Mr. J. R. Booth, the millionaire lumberman, owned the water power, the capacity of which is estimated at about 40,000 horse-power, and he has given a guarantee to the Metropolitan Company that it could obtain 1500 horse-power with but an outlay of $6000.

THE ANCHOR ICE trouble in the Ottawa River during the winter months will this season be overcome by the Ottawa Electric Railway Company by means of a large storage battery. The company has heretofore been troubled with anchor ice getting in the wheels at the power house. The power has been greatly reduced as a result, and occasionally there was not enough available power to run the cars. The new storage battery will act as an auxiliary and as a regulator, and will compensate for any drop in voltage.

A NEW SOURCE OF CARBON FOR CARBIDE FURNACES.—Prof. V. L. Emerson's invention for the conversion of sawdust and saw-mill refuse into commercial products was tested this week before a large gathering of the prominent lumbermen of this district and citizens of Ottawa, among whom were several members of the Dominion Government. Professor Emerson says that the invention is a pre-eminent success. The machine gets its fuel from the gas obtained from the sawdust, so that the process is a continuous one. It runs automatically. First, the sawdust goes through a drying process by having all the excess of heat contained in the burned gases forced through the sawdust in a drying kiln. Then this sawdust is carried by an elevator to the top of the retort, and by means of an automatic feed is supplied to the machine as required. The retort is an upright iron cylinder, between 15 and 20 feet high and about 3 feet in diameter, surrounded by brickwork. Within the retort is a series of hoods on a central hollow revolving shaft, which has perforations under the hoods. The various gaseous products escape through the lower end of the retort, where the liquid products are condensed and separated, emerging through two outlets. At one outlet passes off a wood creosote product, which can be utilized for a variety of purposes, and from the other crude pyroligneous acid, from which can be prepared wood alcohol, acetic acid and various other products. The gases pass through a purifying process, and after being highly heated are forced through the sawdust as it passes down the retort.

The excess of gases passes into the furnace, supplying heat, which is practically sufficient to carbonize the sawdust in the retort. The carbon prepared from the sawdust passes out through an opening for the purpose at the lower end of the retort. The remaining product is a pure form of carbon, which, it is claimed, makes especially pure acetylene gas if used in carbide furnaces.

English Notes.

(From Our Special Correspondent.)

London, October 12, 1898.

THE "ARON" METER.—A company is being floated in this country to take over from Dr. Aron the manufacture of his meter, and has agreed to buy, not only the English patents, but among others the German, Austrian, French and American ones. It is therefore quite probable that in a few months the sale of this meter will be extensively pushed in the United States. The new pattern of the Aron meter is very different from the old one, which has been in use for so many years, chiefly in Germany. Although essentially a clockwork meter, it is now self-winding, and a device has been added by means of which the clockwork and counting mechanism are both reversed every few months, so that any inaccuracy in the regulation of the clockwork is automatically compensated. The instrument will be produced in such quantities that it will be quite possible to compete with motor meters in price, and it has the great advantage that there is practically no inferior limit to its starting current.

[Note.—On page 383 of The Electrical World, October 8, were given some further facts regarding the proposed organization of an American company to handle the Aron meter in the United States.—The Editor.]

THE LONDON COUNTY COUNCIL.—The London County Council has decided to purchase the whole of the system of the London Tramways Company for the sum of £800,000. These lines are at present worked by horse traction, but I should not be surprised to hear that, at any rate on some of them, electric traction will be introduced, although the Council has an amusing prejudice against the overhead trolley. In one instance, they have been obliged to give way in this respect, owing to extreme pressure having been brought to bear on them, and they have permitted the introduction of the trolley on about 1½ miles of an extended system on lines which are being completed in the west of London by the London United Tramways Company, this 1½ miles being the only section within the area of the Council's administration. The London County Council is also worrying about the telephone question, although the service in London in point of efficiency, at any rate, is equal to any in Europe or America. The subscription rates are, it is true, still much higher than in most countries on the Continent, although I believe somewhat lower than in New York; but it must be remembered that the area over which the local service extends is an extremely wide one. The Council intends to ask the Postmaster-General whether he will take the necessary measures for the establishment of a telephone service competing with that of the National Telephone Company in the metropolis, and if he will not consent to do this they intend to apply to Parliament for the necessary powers to establish a municipal system. Glasgow, it will be remembered, has obtained a license from the Postmaster-General, and will also apply for Parliamentary powers in the next session.

INTERRUPTIONS TO ELECTRICITY SUPPLY.—No less than four cases of interruption to supply have occurred since last week, none of them, however, of a very serious nature. The most important occurred in London on Friday night. The private lighting supply from the City of London Electric Lighting Company's station is divided into two sections—lighting the eastern and western districts of the city. At 6 o'clock on Friday night eight Mordey alternators, with Ferranti coils, were running in parallel to supply the western district, when a coil on each of two of the machines broke down simultaneously. These two machines were immediately switched off the bus bars, thus throwing the full load on the remaining four machines, which, unable to furnish the current demanded of them, slowed down and got out of phase, necessitating the whole of that side of the station being shut down. The four machines were immediately started and a fifth also brought into synchronism, the various sub-stations being switched on one by one as each successive machine was paralleled onto the bus bars. Thus the interruption in some cases only last ten minutes, and in none was it longer than of twenty minutes' duration. Two of the other interruptions were due to short circuits on mains in Sunderland and Norwich, respectively. In the former instance it was a concentric cable on a low-pressure network that broke down on Sunday last, and necessitated a stoppage of about half the plant for two hours. In Norwich the short circuit was due to the buckling of a bare copper strip in a bare strip system, thus short circuiting the positive side of the three-wire system, and pulling up the machinery. The stoppage, which occurred at a most important time in the evening, lasted several hours. The fourth case was another one of those oft-recurring conduit explosions, the covers of three surface boxes having been blown out simultaneously. Fortunately nobody was injured, although the accident occurred at 6 o'clock in the evening. Peculiarly enough, the accidents at London and Newcastle were simultaneous to within a minute, and the short circuit at Norwich occurred only about half an hour later.

General News.

The Telegraph and Telephone.

COLUMBUS, OHIO.—The Jefferson & Warren Telephone Company has increased its capital stock from $10,000 to $20,000.

COLUMBUS, OHIO.—The American Telephone & Telegraph Company on October 19 qualified to do business in Ohio by filing articles of incorporation with the Secretary of State.

BOSTON, MASS.—The Erie Telegraph & Telephone Company during the month of September added 1094 subscribers to its system. This makes the total number of connections on October 1, 28,771.

COLUMBUS, OHIO.—Within the next six months the local system of the Union Telephone Company will be completely remodeled at an expense of at least $100,000. Work will be completed in from five to six months.

MEMPHIS, TENN.—The extensions of the long-distance telephone lines in the South are progressing from this city down to New Orleans. It may be possible on January 1 next for Boston to "hello" with New Orleans and Galveston, Tex.

DENVER, COL.—Colorado Springs capital has been interested in a new telephone line to be erected in Oklahoma, $20,000 having been subscribed for the construction. The new company will be known as the South McAllester Telephone Company.

LITTLE ROCK, ARK.—Articles were filed in the Secretary of State's office incorporating the Grand Prairie Telephone Company, of Hazen; capital stock, $10,000. George D. Foster, J. G. Thweats, J. M. McClintock, A. L. Aydelott and David Brockway are the incorporators.

PORTLAND, ME.—The New England Automatic Telephone Company has been organized at Portland for the purpose of conducting a general telephone business, with $500,000 capital stock. The officers are: President, Charles H. Adams, of Boston, Mass.; treasurer, William W. Lowe, of Boston, Mass.

McPHERSON, KAN.—McPherson is now connected with Salina, Marion and Newton by telephone. The line from Newton was completed a few days ago. The toll lines at McPherson, Salina and Newton are all owned and managed by local men, while Newton and Hutchinson are connected by the Bell Telephone Company.

ASHLAND, WIS.—Ashland will soon have two competitive telephone lines to Ironwood. The Wisconsin Valley Company's system has been completed to that point for nearly a month, and the Wisconsin Telephone Company is rapidly approaching that point. The first-named line goes to Ironwood by way of Mellen, while the other crosses the reservation and connects with Odanah and Saxon.

OGDEN, UTAH.—The Rocky Mountain Bell Telephone Company is building a line of No. 8 copper wire from Ogden via Boise City, Idaho, to Portland, Ore., there to connect with the Pacific Bell Company's system, throughout Washington, Oregon and California. The probable extension of the long-distance system during the coming summer, from Omaha to Salt Lake, will make a continuous telephone line across the continent.

WILKESBARRE, PA.—A new telephone company has been organized, and within a few months everything will be in working order. It is known as the People's Telephone Company of Wilkesbarre, and the stock is held by local capitalists, among them John W. Hollenback, George A. Bedford, W. A. Lathrop, Abram Nesbitt, Irving A. Stearns, C. E. Stegmaier and A. Markle. The People's Telephone Company agrees to supply residences with telephones at the rate of $24 a year, and business places at the rate of $30 a year, or both for $50 a year.

FORT SMITH, ARK.—The Pan Telephone Company is again operating its plant in this city. The resumption of the old name comes about by the sale which was made recently. About a year ago L. E. Ingalls sued the Arkansas Telephone Company in the Federal Court here for money advanced by him to rebuild the plant of that company in this city. Judgment was rendered against the company, and Col. James Brizzolara purchased the plant and satisfied the judgment. Col. Brizzolara sold the plant to L. E. Ingalls for $7500, and then Mr. Ingalls sold it to the Pan Telephone Company for $14,950.

SEDALIA, MO.—Another long distance telephone line is to be constructed between St. Louis and Kansas City via Sedalia. It will be a direct competitor of the line now being completed, and the result will probably be a material reduction of rates for this city and all other intervening points. The company back of the enterprise is composed chiefly of St. Louis capitalists, but Kansas City parties will also be interested, and another exchange for that city is one of the possibilities of the near future. The St. Louis parties are said to include the gentlemen interested in the Weir-Kinloch plant of that city. The company's capital stock is $10,000,000.

Electric Light and Power.

MONROE, LA.—The City Council will issue $50,000 bonds for an electric light plant.

BENNETT, PA.—On November 8 the question of issuing $25,000 electric light bonds will be voted on.

ATLANTA, GA.—At the recent election in this city the proposition for a municipal electric light plant was adopted.

JONESVILLE, MICH.—At a special election to vote on bonding the town for $28,000 for electric lights and water works, the proposition was carried by a large majority.

KOKOMO, IND.—The electric light plant of the Citizens Light & Power Company, at Kokomo, in the hands of a receiver, by order of court, will be sold November 12

WINONA, MINN.—The City Council has decided to investigate the feasibility of the city operating its own lighting plant, and has appointed a committee to report not later than January 1 next.

BUTLER, IND.—The town of Butler has purchased the electric light plant in this city owned by Henry McIntyre, the consideration being $8500, on such terms that the town can pay it out of the profits.

SOUTH MILWAUKEE, WIS.—The ordinance passed by the South Milwaukee Common Council for the purchase of the electric lighting plant by the city was returned to the Council at the meeting of that body, with the mayor's veto.

GRAND RAPIDS, MICH.—After quibbling with the lighting plant question for more than six months the Common Council has approved the contract with the Chase Construction Company for a complete plant to cost about $136,000.

ASBURY PARK, N. J.—A committee has been appointed by the Council to look into the cost of installing an electric light plant in connection with the water works, to be owned and operated by the city. Messrs. Appleby, Harvey and Keator constitute the committee.

YORK, PA.—The Martic Electric Power Company, of York, Pa., which has purchased the Susquehanna & Tidewater Canal, running from Wrightsville, York County, to Havre de Grace, Md., is contemplating the introduction of trolley canal boats on the canal, the power to be supplied from its plant in the Susquehanna River, near Wrightsville.

DOYLESTOWN, PA.—The stockholders of the Newtown Electric Light & Power Company have agreed to lease the plant to the Newtown Electric Street Railroad Company. The lease runs for a term of twenty years, and 5 per cent. is guaranteed the shareholders. It is intended to greatly increase the capacity of the plant, and it is said the new management will spend $40,000 on the improvements.

ROCKFORD, ILL.—The City Council has granted a franchise extension of twenty-five years to the Rockford Light & Power Company, on condition that it be consolidated with the Rockford Traction Company within one year. The company is obliged to pave and repave between its tracks, and provide cars with vestibule and fenders. An amendment for 3-cent fares and other propositions which it was feared would kill the consolidation were lost.

BOSTON, MASS.—In a report covering the operations for the six months ended June 30 last, President Rogers, of the Edison Electric Illuminating Company, states that the first, second and third stations of the company are now equipped, not only with steam plants, but with storage batteries, while the fourth and fifth stations are equipped with storage battery only. The company now has the largest storage battery installation in the world. The company had connected at the date mentioned 161,466 incandescent lamps, 1486 arc lamps and motors with an aggregate capacity of 6473 horse-power.

PHILADELPHIA, PA.—The Electrical Committee of City Councils considered the estimates for the next year of the electrical bureau. Director Riter explained that a saving of upward of $21,000 will be effected next year in the cost of electric lighting throughout the city, on the basis of 7003 lights, the existing number. The average price per lamp per night will be 31 84-100 cents, or about $116.22 a year. The cost of 7003 lamps this year will be $835,134.60, as against an estimated cost of $813,908.75 for next year, the proposals for 1899 being proportionately lower than in 1898. The item was passed for this amount and a new item was introduced for $100,000 for additional lamps.

SEATTLE, WASH.—Mr. G. M. Esterly, superintendent of the Dawson City Electric Light & Power Company, who has been in the States for the last few weeks purchasing apparatus for his company, gives some interesting information regarding the prices paid in the Klondike region for labor and materials. His company purchased 4000 cords of wood at $14.75 a cord, making $59,000 in all. Teams were hired at the rate of $10 an hour each, at the beginning of the work. Hay and feed for horses cost $500 a ton, and a team may be hired without a man to drive it for $25 a day, which is now considered quite a reasonable sum. Arc lights at Dawson bring $14 a night, and incandescents from 50 cents to $1.25. Even at these seemingly enormous prices, Mr. Esterly states that his company could use 4000 lights if it had them. Electric light is cheaper than kerosene, he says, for oil is $2 a gallon. The Dawson City Electric Light & Power Company was recently incorporated with a capital of $75,000.

THE ELECTRIC RAILWAY.

TOLEDO, OHIO.—The Toledo Traction Company, of which Norman B. Ream, of Chicago, is the principal stockholder, has purchased the Toledo Electric Company, the purchase price being $325,000.

ALLEGHENY CITY, PA.—The Mt. Troy & Reserve Township Traction Company has suspended operations, at least for a time. This company was organized some time ago, but has only been operating about a year.

WESTFIELD, MASS.—George W. Dunham, president of the Springfield & Hartford road, is making plans to build a line through Feding Hills to Westfield, which will connect with the Woronoco line running from that place.

CANANDAIGUA, N Y.—It is announced that the Canandaigua Electric Light & Railroad Company, of this place, will discontinue running the trolley cars during the months of December, January, February and March, as it is privileged to do by its charter.

SIOUX FALLS, S. DAK.—The electric line between Sioux Falls and East Sioux Falls, S. Dak., has been torn up by the Eastern owners. The equipment was shipped East. The line paid dividends at one time, but during the last two years it has done no business.

NEWTON CENTRE, MASS.—The Newton & West Roxbury Street Railway Company has been granted a franchise to run its cars from the Dedham line through Dedham, Parker, Boylston and Walnut Streets to Newton Highlands. This will connect the Newtons with the remote Oak Hill district.

SANTIAGO DE CUBA.—A franchise for an electric railway to run from Santiago to the cemetery and to El Caney has been granted by General Wood to prominent local business representatives. It is said that this road will be a very great public convenience, although it is hardly likely to more than pay expenses for the first three years.

NORRISTOWN, PA.—The Schuylkill Valley Traction Company has reorganized by electing the following officers: President, C. D. Beebe; directors, C. D. Beebe, N. H. Larzelere, R. M. Douglass, Thomas Corday, D. B. Shepp, H. S. Holden and G. B. Leonard; general manager, secretary and treasurer, R. M. Douglass; superintendent and electrician, A. G. Davids.

PITTSBURG, PA.—Owing to numerous delays the new Monongahela traction line to McKeesport will not be ready for running until November 1. It was expected to have it in shape for cars to be started October 1, but numerous delays by injunctions from property holders and other causes have held back the work. It is intended to make it one of the best traction roads in the country.

NEW YORK CITY, N. Y.—The Twenty-eighth and Twenty-ninth Streets Railroad Company, of this city, has secured permission from the State Railroad Commission at Albany to change the motive power on its lines from horses to compressed air. The company applied for permission to change its motive power to either the underground electric conduit system, storage batteries or compressed-air motors.

SANDUSKY, OHIO.—A syndicate is negotiating for the purchase of the Sandusky, Milan & Norwalk Electric Railway and the People's City line. The transaction is said to be the first step in a plan to build electric railways connecting a large number of northern Ohio cities and towns with Cleveland. John McKelvey, a well-known railroad man, is engineering the deal, and it said that the papers will be signed in a few days.

NEWPORT NEWS, VA.—The sale of the Newport News, Hampton & Old Point Electric Railway Company has been effected. The consideration in this sale is given as $750,000, but it is said that at least $1,000,000 will change hands as a result of the deal. The purchasing company was organized some months ago for the purpose of building a line run in opposition to the one already in existence, and has secured some valuable franchises.

UTICA, N. Y.—The Utica Belt Line Railroad Company is erecting on the line of its road a new riveted lattice bridge having a span of about 75 feet. The bridge is known as the Halfway Bridge. It is a modern structure in every way for the class of work which it is called upon to do. It is to be all steel except the cross ties on which the rails rest. The Berlin Iron Bridge Company, East Berlin, Conn., has the contract for furnishing and erecting the steelwork.

BROOKLYN, N. Y.—Counsel of the Brooklyn Heights Railroad Company informed District Attorney Marean in Brooklyn a few days ago that the company had agreed to grant the demands of its men based on the ten-hour law. The men some weeks ago called the attention of the District Attorney's office to repeated violations of the law by the company. They complained that by working them according to the "swing system" they were getting from sixteen to twenty hours work a day out of each man.

BOSTON, MASS.—It is stated that the controlling interest in the Rockland & Abington Street Railroad Company has been bought by Pepper & Register, representing a Philadelphia syndicate. The road has a capital of $120,000, and has paid an annual dividend of 6 per cent. It is a valuable piece of property, being the connecting link between Brockton and shore travel to Nantasket. It is reported that this is the first step toward the consolidation of all the electric street railroads in Southeastern Massachusetts.

BOSTON, MASS.—W. P. Clark, of Peabody, Mass., has been appointed receiver of the Newburyport & Amesbury Horse Railroad Company, upon application of the Mechanics' Savings Bank, of Providence, R. I., which holds $25,000 of the company's bonds, on which the September interest was defaulted. The railroad company in 1892 made a mortgage of all its property to the International Trust Company, of Boston, to secure an issue of $350,000 of bonds, with the understanding that the trust company was to act as trustee for the bondholders. After the September coupons were defaulted, it is alleged, the International Trust Company was asked to begin foreclosure proceedings, but it declined to do so. Hence the present proceeding by the Mechanics' Savings Bank.

SAN FRANCISCO, CAL.—In a decision rendered on October 14 Superior Judge Seawell dismissed the application of the Board of Railroad Commissioners for a writ of mandate to compel the Market Street Railway Company (Southern Pacific) to produce its books for examination. The commission wished to fix a schedule of street-car fares, but Judge Seawell holds that the term "railroad" in the statutes does not refer to street railways in the true meaning of the word, and that the law does not imply the power to fix passenger rates, and that any other interpretation would involve the carriers of passengers and freight by coach and baggage companies. Judge Seawell holds that only municipal authorities have the power to fix the rates of street-car lines. The case will be appealed to the Supreme Court.

MT. CLEMENS, MICH.—Receiver J. G. Tucker, of the Detroit & River St. Clair Railway, has effected a sale of his road to the Detroit, Lake Shore & Mt. Clemens Company. The sale also includes the tracks and franchises of the traction company in the streets of Mt. Clemens. These will afford the Lake Shore people an outlet over Gratiot Street to the city limits, whence it is proposed to construct the road over the intervening gap of 5 miles to connect with the Chesterfield line. This done, the Lake Shore will have a continuous roadway from Detroit through Mt. Clemens, Chesterfield and New Baltimore to Marine City. It is proposed to build the balance of the road this fall and equip the Chesterfield branch with electricity so that the Lake Shore parlor cars can run into St. Clair River ports by the time navigation closes.

LEGAL NOTES.

CORRECTION.—In THE ELECTRICAL WORLD of October 8 last, under this head, was published a paragraph in reference to the injunction granted in the suit of the Sprague Electric Railway & Motor Company v. the Detroit Citizens' Street Railway Company. The name of the Walker Company was there coupled with this suit. The Walker Company writes to the effect that it "has never supplied any motors or equipments to the above mentioned railway company, nor to any other street railway in Detroit, with the exception of the Mt. Clemens Fast Line." The use of the Walker Company's name in this connection was, therefore, an error.

ELECTRIC WIRES.—The owner of electric wires carrying a dangerous current is chargeable with negligence in stringing them over a bridge so near the top of it that it is impossible to make repairs on the bridge without coming in contact with them. A workman making repairs has a right to assume that contact with them will not be dangerous, especially after the workmen have made an examination of them, and ascertained, as they suppose, that the wires are not dangerous. The apparent perfect insulation of electric wires, which is calculated to deceive and to cause one unfamiliar with the facts to suppose them safe, amounts to an invitation to them to risk contact therewith. Perham, Admr., v. Portland Electric Company, Oregon Supreme Court, 1898.

LIABILITY FOR KILLING A DOG.—A dog is not a tresspasser on a street car track which is laid in the highway on the same level with it. The right to recover for injury to a dog is not lost by killing him under the honest but mistaken belief that he was fatally injured. A motorman cannot rely upon the quickness and celerity of a dog to absolve himself from all duty and care to prevent running over him with an electric car. The owner of a dog has such property in him that he may maintain an action for killing or injuring him. A

street railway company is liable for the killing of a dog by an electric car, caused by the negligence of the motorman. Citizens' Rapid Transit Company v. Dew, Tennessee Supreme Court, 1898.

ENCLOSED ARC LAMP DECISION.—In the suit of the Marks Enclosed Arc Light Company, New York, v. The Washington Mills Company, New York, a decision has just been rendered in favor of the complainant. The suit was begun in the United States Circuit Court September 10, 1897, and the decree granted to the Marks Company by Judge Coxe on October 18, 1898. The patent infringed is No. 520,996, of Marks & Ransom, dated June 5, 1894. This patent broadly claims the method of operation used in all modern enclosed arc lamps. The Washington Mills Company was a user of the Kinsman lamp sold by the Electric Construction & Supply Company, New York. The decision peremptorily stops the sale of unlicensed enclosed arc lamps by the Kinsman Company, and also involves the payment of damages by the defendant.

Personal Notes.

MR. M. COKELY, who is probably known to many of our readers, has been appointed superintendent of the works of the C. W. Hunt Company, Staten Island, N. Y., assuming the duties of that position October 14 after several months' work revising the factory systems. Mr. Cokely was for many years with the General Electric Company, and later with other prominent firms.

MR. GEORGE F. BRUNT, president of the Brunt Porcelain Works, of East Liverpool, Ohio, on October 24 shot and killed his hostler, Dudley E. Lee, the son of a colored minister of Pittsburg. Brunt discharged Lee the Saturday before, but the latter returned, and an altercation ensued. Lee followed Brunt to the latter's home and entered the house, when Brunt shot him. Brunt surrendered and was released on $10,000 bond.

MR. D. W. MORRISON, well known as a constructing engineer for the Chicago Edison Company, has accepted a position to go to England and put in two important steam plants. He is to do the work for the Crane Company, afterward acting as its agent for Great Britain. His first installation will be the 12,000-hp plant which will supply the electric current for the Central Underground Railroad of London, now nearly completed. This will be a condensing plant with a cooling tower, using Allis engines, Babcock & Wilcox boilers and General Electric dynamos. The second task will be the United Traction Company's power house at Dublin. The latter will be a surface condensing plant of 5000 horse-power. Mr. Morrison had charge of the installation of the Harrison Street power house of the Chicago Edison Company, and has been identified with a number of the prominent electrical plants of the Western cities. His selection forms another instance of the lack of engineers abroad with American methods and ability.

Directory of Scientific Societies, Associations, Etc., and Meetings of the Same.

THE NEW YORK ELECTRICAL SOCIETY.—President, Gano S. Dunn; secretary, George H. Guy, 120 Liberty Street, New York. Next meeting, October 27, at Brooklyn Edison Station, Brooklyn, N. Y.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA, Pittsburg, Pa.—Meetings, third Tuesday of each month.

CHICAGO ELECTRICAL ASSOCIATION.—Meetings, first and third Friday of each month, from October 1 to June 1; J. R. Cravath, secretary, Monadnock Block, Chicago, Ill. Future meetings and paper for the season of 1898-99: "Practical Points on Electrical Measurement," by W. B. Hale; November 4, "The Electrical Equipment of a Model Printing Establishment," by George A. Damon; November 18, "The Development of the Motorcycle," by F. B. Rae; December 2, "Practical Points in Street Railway Engineering," by W. A. Harding; December 16, "Wireless Telegraphy," by Arthur V. Abbott; January 6, 1899, "Telephone Engineering—Some Problems Solved and Unsolved," by S. G. McMeen; January 20, "Observations on Ventilating Fans," Gerard Swope.

NORTHWESTERN ELECTRICAL ASSOCIATION.—President, F. A. Copeland, La Crosse, Wis.; secretary, Thomas R. Mercein, Milwaukee, Wis.

MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION, Boston, Mass.—Exhibition of Motor Carriages, October 10 to December 3, 1898. (See report of exhibits on other pages in this issue.)

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.—President, G. Tracy Rogers, Binghamton, N. Y. Secretary, Henry A. Robinson, New York City. Next meeting, Ithaca, N. Y., September 12 and 13, 1899.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—President, A. M. Young, Waterbury, Conn.; secretary, George F. Porter, 203 Broadway, New York. Next meeting, New York, May or June, 1899.

AMERICAN STREET RAILWAY ASSOCIATION.—President, C. E. Sergeant, Boston, Mass.; secretary, T. C. Penington, 2020 State Street, Chicago, Ill. Next meeting, Chicago, 1899.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—President, W. W. Ryder, Chicago; secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Wilmington, N. C., June 19, 1899.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, New York.—President, Dr. A. E. Kennelly; secretary, Ralph W. Pope, 26 Cortlandt Street, New York. Meeting, fourth Wednesday of each month, from September 1 to June 1.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.—President, R. R. Bowker, New York; secretary, Wilson S. Howell, P. O. Box, 114, Newark, N. J. Next meeting, 1899.

THE PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. President, W. F. Pierce; secretary, George P. Low, 427 Tenth Avenue, San Francisco, Cal.

THE OHIO ELECTRIC LIGHT ASSOCIATION.—President, Emil C. Schmidt, Sandusky; secretary and treasurer, Samuel Scovil, care of Cleveland Illuminating Company, Cleveland. Next meeting place, Cleveland, 1899.

INDEPENDENT TELEPHONE ASSOCIATION OF THE UNITED STATES.—President, Judge James M. Thomas, Chillicothe, Ohio; secretary, W. J. Vesey, Fort Wayne, Ind. Next meeting, June, 1899. Place to be named hereafter.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.—Dr. Francis B. Bishop, Washington, D. C., president; Dr. John Gerin, Auburn, N. Y., secretary. Next meeting, Washington, D. C., September 19, 20 and 21, 1899.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.—President, Robert E. Wright, Allentown; secretary, S. P. Light, Lebanon. Last meeting, Scranton, Pa., September 7-8, 1898.

ASSOCIATION OF FIRE AND POLICE TELEGRAPH SUPERINTENDENTS AND MUNICIPAL ELECTRICIANS.—President, J. W. Aydon, Wilmington, Del.; secretary, H. T. Blackwell, Jr., New York. Next meeting, Wilmington, Del., September 5, 1899.

THE SOUTHWESTERN GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION.—President, Carl F. Drake, Austin, Tex; secretary, E. L. Wells, Jr., Marshall, Tex. Next meeting, Austin, Tex., April 19, 1899.

FRANKLIN INSTITUTE (Electrical Section), Philadelphia, Pa.—Secretary, William H. Wahl.

Trade and Industrial Publications.

THE TROPENAS STEEL PROCESS is the title of a reprint of a paper read by Alexandre Tropenas before the last convention of the American Foundrymen's Association, describing this process of steel making, the main point of interest of which to electrical engineers is the fact that the product of this process—which is of the small converter type for converting pig iron into steel—is a practically pure iron (99.75 to 99.80 per cent.), possessing a high magnetic permeability and great homogeniety, and is consequently useful for dynamo-electric machinery. The process is now being introduced into the United States, one 2-ton converter having been installed in the works of the Driggs-Seabury Gun & Ammunition Company, Derby, Conn.

THE SOUTHERN BELL TELEPHONE & TELEGRAPH COMPANY has published a rather novel brochure, copies of which are being distributed by Mr. H. W. Pope, traffic manager. This neat little pamphlet is intended as an educational aid to telephone users, illustrating prettily the wrong way and the right way of using the telephone, giving a view of the B. W. C. party-line instrument, with selective call and locking and indicating device, and describing and illustrating the private branch exchange service of the company. It also gives some instructive statements of relative cost of doing business at long distance by traveling, by telegraph and by telephone. The representation of a crocodile conversing over the telephone with a polar bear is not intended as a picture from life of the use of the company's wires, but to give an impression of the distances over which conversation may be carried on even at the present time.

Trade and Industrial Notes.

THE WM. MUELLER ELECTRIC COMPANY, Chicago, has just gotten out a new catalogue of electrical supplies. A copy of it will be sent to any address on application.

THE HARVARD ELECTRIC COMPANY, 52 Dearborn Street, Chicago, invites requests for prices on its combination fuse and carbon lightning arrester and cut-out for telephone and telegraph instrument protection.

THE WESTERN ELECTRIC COMPANY, Chicago, has distributed a number of its Bulletin No. 7002, which is descriptive of arc lamps of its manufacture. A copy will be sent upon request to any person interested in the operation of an arc-light plant.

THE WEISMANTEL FEARLESS CAR FENDER COMPANY has filed articles of incorporation at Passaic, N. J., with a capital stock of $150,000, and will engage in the manufacture of a newly patented trolley-car fender and other appliances for street cars.

MR. GEORGE W. HOFFMAN, 295 East Washington Street, Indianapolis, Ind., whose metal polish paste is so widely known and used, has just shipped two large foreign orders. He reports business very good, and points to the fact that honest and reliable goods are sure to find favor.

THE ILLINOIS ELECTRIC COMPANY, Chicago, announces that it is having a large run on the Edison, Jr., improved incandescent lamps. It reports having sold thousands of these lamps to the trade this fall with best results. Duplicate orders have been received. A trial order from the trade is requested.

BERLIN BRIDGES AND BUILDINGS.—The Berlin Iron Bridge Company, East Berlin, Conn., each month produces a neat publication, which is devoted to a description of bridges, buildings, etc., built and erected by this well-known concern. The August number is the fifth of the first volume, and contains sixteen pages. Its contents, in addition to the technical matter, include items of interest to the farm and home and of general information.

THE HELIOS COMPANY, Philadelphia, Pa., has received through its Boston agent, the Anchor Electric Company, a large order for its lamps from Jordan, Marsh & Co., Boston. This order was, we are informed, finally awarded to the Helios Company after protracted and severe tests of all the most prominent lamps on the market. The company also reports the receipt of large orders from abroad, taxing the company's factory facilities to the utmost.

ELECTRIC LIGHT AND POWER IN A WAGON FACTORY.—The entire plant of the Fish Brothers' Wagon Company, at Racine, Wis., has been equipped with an electrical power and light outfit. The switchboard, which is of marble, is one of the largest in the Northwest, and is said to be the acme of perfection. The entire equipment was furnished and put in by the Julius Andrae & Sons Company, of Milwaukee, Wis. The company's new catalogue of telephones and electrical supplies is now ready for distribution, and will be sent to any address free of charge.

PACKARD TRANSFORMERS.—It has always been the policy of the Pack-

ard Company to improve its products whenever opportunity offered. Its model '98 Packard transformer represents its latest improvement in the transformer line, and it claims that this apparatus is at the very top notch of transformer construction. It has a novel plan of guaranteeing just exactly what each transformer will do. All of its claims, guarantees, etc., are fully set forth in a special circular, a copy of which can be had from the Electric Appliance Company, Chicago, Western agents for the Packard goods.

THE CHARLES E. GREGORY COMPANY, of Chicago, of which Mr. A. Louis Kuehmsted is treasurer and general manager, has purchased the entire business of the Electrical Exchange of the same city, including all the stock and machinery on hand as well as the good will and even the name and title. Mr. Kuehmsted is certainly to be congratulated on this latest exhibition of his energy and progressiveness. The extent of the business done at the present time by the Charles E. Gregory Company under Mr. Kuehmsted's management would not have been believed by electrical engineers a few years ago. It is said on good authority that the company has done a business of a quarter million dollars during the last six months. There can therefore be no question of the promising field open to dealers in second-hand electrical mcahinery who work on the broad and liberal lines on which Mr. Kuehmsted has built up his business.

"IMPROVED BRUSH ARC LAMPS" is the title of an artistic brochure just issued by the General Electric Company, dealing with the modifications introduced in the latest types of single and double Brush arc lamps as experience with the operation of past types has dictated. Each detail of improvement is explained clearly and concisely, and in conjunction with first-class half-tone illustrations, so that even persons unfamiliar with the Brush lamp mechanism will find no difficulty in grasping the import of the various changes and improvements. The leading features are summarized, each under its own heading, and the brochure concludes with a full catalogue of the parts not only of the improved lamp but also of lamps 30 and 31. The pamphlet is issued from the General Electric Company's own printing office, and in general artistic appearance, letterpress and illustrations compares well with the work of our best catalogue makers. It will be sent to those interested on application to any of the company's sales offices.

ELECTRIC MINE LOCOMOTIVE.—In a recent letter to the Westinghouse Electric & Manufacturing Company, Mr. R. G. Vance, Jr., superintendent of the Stevens Coal Company, makes the following statements regarding the Baldwin-Westinghouse electric mine locomotive in operation in its mine: "It gives us pleasure to say that this motor is giving the very highest possible satisfaction, and is attracting considerable attention in this valley. It has been running since May 1, and has not cost a dollar in the shape of repairs, excepting a new valve for sand box and a head-light base, broken in a collision with a car. It is running on a road of 25 per cent. steel 4000 feet long over undulating grades varying from 1 to 6 feet per 100 feet. Its regular load now consists of twenty cars of 1½ tons capacity, and the time required for each trip is from seventeen to nineteen minutes. We have pulled as high as twenty-five of these cars at one trip, which it did with all ease. When necessity requires we can pull thirty cars, giving 50 per cent. more capacity than you guaranteed."

MOULDED PORCELAIN.—The Mica Insulator Company, of New York, Chicago and London, states that there is a gratifying demand for its commutator rings. The company makes a specialty of manufacturing moulded insulation, and is now turning out for some of the large manufacturers of electrical machinery moulded rings all in one piece. This pattern of ring, it is stated, is one of the most difficult articles in the insulation line to manufacture. As it comes from the machinery employed by this company in its manufacture, it is said to be as perfect as a piece of stamped steelware, and has the same metallic ring. Another form of insulation, of which the company has made a specialty, is the armature trough or slot, which is now in use by many of the manufacturers of motors for crane work, and for those who require a heavy insulation which will stand very high voltages. While this form of insulation is a trifle more expensive than the common red paper and mica, yet those concerns that manufacture electrical machinery which gets rough usage have found it necessary to use the best possible insulation for their armatures. Electrical manufacturers would do well to communicate with the company, sending blue prints for estimates.

"SOFT COAL BURNING" is the title of a pamphlet issued by the "Railway Master Mechanic," Chicago, Ill. The author of the treatise is Mr. C. M. Higginson, who is an acknowledged expert on the subject of combustion. This is the fifth edition of the work, and has been rewritten and enlarged from the fourth edition. It has long been considered a standard treatise on the important subject of the burning of soft coal. The question of smokeless combustion of coal is attracting a great deal of attention at the present time, especially in Western cities, and the agitation has reached such a pitch that ordinances have been passed by the Common Councils in several cities to establish a series of fines for the unnecessary emission of smoke within the city limits from the chimneys of manufactories, steamboats or locomotives. The author discusses the means of obtaining economical and smokeless combustion of soft coal, and employs diagrams to aid in a better understanding of the subject. He does not claim any original discovery in the matter of coal burning, but merely notes results of methods and experiments covering a long period, and concludes that there is no reason why the results arrived at by the adoption of well-known devices and principles should not be duplicated anywhere under the same conditions.

A COMPLETE VALVE CATALOGUE.—The illustrated catalogue and price list of the Roe-Stephens Manufacturing Company, Detroit, Mich., shows a very complete line of gas valves, swing checks, safety valves, throttle valves, etc. The company calls particular attention to its new lines, prominent among which are its extra heavy pressure gate valves. These are designed for the heaviest steam working pressure, and are made of the best material and by first-class mechanics. They have been accepted by the Government in the New York City Post Office and other places where high-pressure work has been installed, and are largely used in electric railway and electric light plants where high pressure is used. Another important addition is the extra line of extra heavy nickel seat pop valves. The various valves are very clearly illustrated, and each classification is accompanied by a table showing the different sizes and prices. The Goldsmith throttle valves manufactured by this company are especially adapted for stationary and marine engines and large steam pumps. They open and close easily and quickly, and all the parts can be taken from the body and replaced without breaking pipe connections. In their operation they never leave their seats; they follow and take up their own wear. The company manufactures a very complete line of steam, brass and iron goods.

ENCLOSED ARC LAMPS FOR EXPORT.—The Standard Thermometer & Electric Company, Peabody, Mass., has lately received a European order for 1000 alternating-current enclosed arcs. That American enclosed arcs should be ordered for European service is not remarkable, considering the poor mechanism of this type built on the other side, but the Standard Thermometer & Electric Company takes considerable pride in the fact that it obtained the order in the face of sharp open competition. This company also, as may not be very well known, makes a lamp without a clutch, the feeding mechanism consisting simply of a solenoid supporting the weight of the carbon and carbon holder, with its winding and plunger adapted to give a uniform lift with the same current over a considerable travel. This style of lamp is expensive to build, and only economical in locations where lamps with complicated mechanism are barred out by special conditions. Such a case is that of the service of the Solvay Process Company, of Syracuse, which manufactures bicarbonate of soda, commonly known as soda ash. This finely ground material floats so thickly through the air that the clutch will not work at all, but the so-called "long" lamps of the Standard Thermometer & Electric Company without clutches have been in satisfactory service in these works for some two and a half years.

ARTIFICIAL DRAFT.—The subject of draft is an important one in connection with electric light and power stations, and an extract from a treatise on "Mechanical Draft," published by the B. F. Sturtevant Company, Boston, Mass., will be of interest in this connection. Mr. W. S. Hutton, the author of the treatise, states that "artificial draft can be readily adjusted to effect the combustion of different kinds of fuel at different rates of combustion. It permits efficient combustion of fuel of inferior quality, and enables a steady supply of steam to be maintained, independent of climate and weather. It enables the supply of air to be properly distributed to the fuel in the furnace to effect economical combustion. The supply of air above the fuel can be readily adjusted to effect combustion of the gases evolved by the fuel, and the supply of air below the fuel can be regulated to effect the combustion of the solid portion of the fuel, and the movement of the hot gases can be readily controlled. There is no valuable feature of the chimney that is not possessed by the fan to at least the same and in many cases to a more marked degree. The very features which are most conducive to economy are those which are incidental to the use of the fan for draft production. While the recent extensive introduction of induced draft in stationary practice has done much to emphasize the advantages of this system, the general superiority of mechanical draft, properly applied, has long been recognized by those who have given careful consideration to the matter."

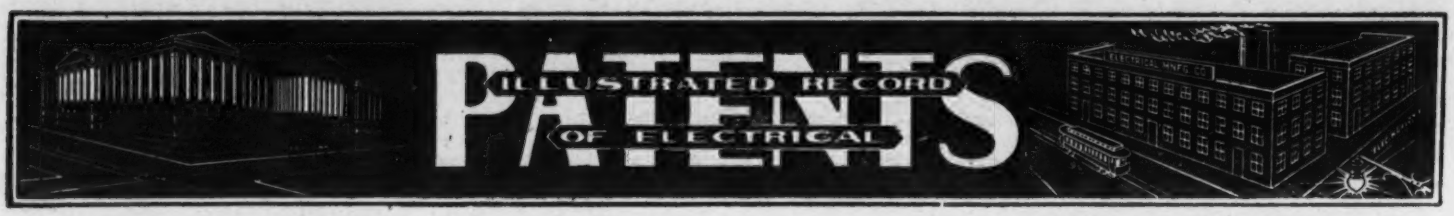
THE IRON CLAD RESISTANCE COMPANY, of Westfield, N. J., lately organized, has purchased the plant, patent rights and all property formerly belonging to the Iron Clad Rheostat Company of the same place. The new company will continue the manufacture of the general type of apparatus heretofore produced by its predecessor, but with modifications which the long experience of the management of the present company has taught them to consider necessary to the successful performance of rheostats of this type. The personnel of the new organization is such that the company's customers may be assured of benefiting by all the resource and foresight which comes from thorough familiarity with the requirements for and manufacture of the product. Mr. R. H. Mansfield, Jr., the president of the new company, has been for some years general manager and superintendent of one of the largest rheostat manufacturing concerns in the country, and is well known to the trade through the connection. His prior experience as an electrical engineer was such as to make him eminently well fitted to appreciate the requirements which the product must meet in practice. Mr. A. W. Berresford, the vice-president, was for two years in charge of the testing and designing department of the same company, and in that capacity personally supervised the construction and testing of all of the product. Mr. A. P. Munning, secretary and treasurer, has had a wide experience in the financial and selling end of this line of apparatus. The new company is an absolutely independent concern, having no connection with any other house in the trade, and the management feels sure, from the points of advantage shown by the Iron Clad Type of resistance in recent tests with the improved methods of construction applied, that this apparatus will meet with approval from the entire electrical fraternity.

THE RASTER CARBON RHEOSTAT COMPANY, Chicago, Ill., has but a short time been in position to offer to the trade a full line of controllers, starters and regulators, but notwithstanding this the orders received for rheostats of various kinds are said to be now running into the thousands of horsepower. The company refers with pride to the success with which its devices have met, and believes that such a record is unparalleled. All of its apparatus is manufactured under patents controlled by the company; its automatic release for motor starters is manufactured under the Jenney patent. Many people who were skeptical as to the advisability of using carbon for resistances have, after being placed in possession of the facts, become the company's warmest friends, and from such the company is continually receiving duplicate orders. The Raster Company has lately made some very handsome rheostats, which have been shipped to Europe and Australia. All of the Raster rheostats are radically new in design. The method employed by the company of assembling its resistances and the construction of its devices are claimed to be all original. The company has been obliged to make some radical change in its factory to enable it to fill its orders with more promptness, so great has been the rush for its products. It makes a great point of prompt delivery, and has won many patrons by its attention to the trade and its methods. The company has recently secured some excellent orders for theatre dimmers, and feels much gratified over the results it is obtaining. The Raster Company states for the benefit of those who contemplate entering the business without having covered the field fully with patents, that all its appliances are fully covered by patents, not only in America, but in all countries on the globe, so that it is prepared to handle and protect business from any source whatever.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 9-15 Murray Street, New York City.

HAWAII AND THE PHILIPPINES.—Send 4 cents (in stamps) for an illustrated booklet issued by the Chicago, Milwaukee & St. Paul Railway, the direct route across the American continent to the new trans-Pacific possessions of the United States. Full of latest reliable information and valuable for reference. Can be used as a text book in school. Address William Kelly, Jr., G. E. P. A., 381 Broadway, New York.



UNITED STATES PATENTS ISSUED OCTOBER 18, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

612,410. ELECTRIC TROLLEY DEVICE; A. J. Gairing, of Johnstown, Pa. App. filed Aug. 3, 1898. The combination of a single transverse torsion spring secured at each end on the vehicle and a contact carrying arm having its lower end secured about the central portion of the said spring.

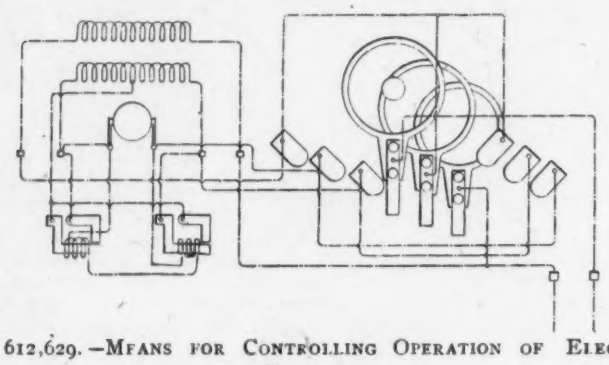
612,426. ELECTRIC METER; W. D. Marks and G. R. Green, of Philadelphia, Pa. App. filed Jan. 10, 1898. In an electric meter, the combination of a controlling arch, the position of which is determined by an ampere indicator, a pawl-carrying arm or lever co-operating with said arch and effecting the registration, a driving shaft, a driving cam carried by said shaft for actuating said pawl-carrying lever, an overweighted disc pendulum on said shaft and a motor for oscillating said pendulum.

612,427. ELECTRIC METER CASE; W. D. Marks, of Philadelphia, Pa. App. filed Jan. 10, 1898. An improved casing for electric meters, comprising a box, a frame carried by said box, a glass panel in said frame, and a metallic plate fastened in front of said glass panel and having an opening therein.

612,457. ELECTRIC RAILWAY; C. H. Meyers, of Buffalo, N. Y. App. filed Aug. 18, 1897. In an electric surface railway, the combination of a turntable, a hanger attached thereto, an arm pivoted to said hanger and carrying a traveler, and an adjusting lever mounted on the turntable and operatively connected with the arm, substantially as described.

612,535. SYSTEM FOR INSULATION OF ELECTRIC CONDUCTOR WIRES; J. H. Vail, of Philadelphia, Pa. App. filed Feb. 26, 1898. In combination with an electric conductor, an insulating covering for a portion of same, consisting of a plurality of sleeves, one within another, each sleeve being split, and having its joint or line of division breaking joint with the joint of the adjacent sleeve.

612,556. ELECTRIC ARC LAMP; C. A. Vigreux and L. V. Brillie, of Levallois-Perret, France. App. filed March 30, 1898. In an arc lamp, the combination of two carbon-holders, a brake fly-wheel, means to connect said fly-wheel to the carbon-holders, an arm suspended from the axis of the fly-wheel, a ring surrounding the fly-whel and pivoted on the above-mentioned arm, a brake block formed at the internal circumference of the ring, and



No. 612,629.—Means for Controlling Operation of Electric Motors.

means to electrically rotate the ring in order to regulate the pressure of the brake block on the fly-wheel, and thereby effect the regulation of the electric arc.

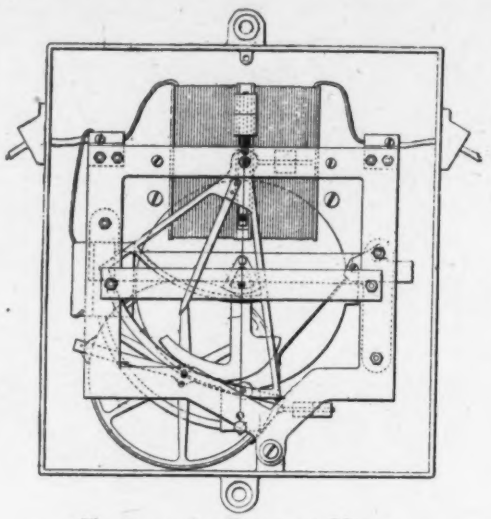
612,560. ELECTRIC LAMP SOCKET; J. E. Criggal, of Newark, N. J. App. filed Nov. 4, 1897. In an incandescent electric lamp, the combination, with a non-conducting socket base, of spiral conducting wires sealed into said base and forming at their outer ends a helical holder, and each having at its inner end a threaded spiral eye open at one side and forming a single turn and constituting a binding post for a circuit wire.

612,629. MEANS FOR CONTROLLING OPERATION OF ELECTRIC MOTORS; J. D. Ihlder, of Yonkers, N. Y. App. filed Jan. 26, 1898. In a starting and stopping device for electric motors, the combination with the motor and circuits therefor, including a parallel circuit to the armature, of resistances in said parallel circuit, magnets controlling said resistances and means for controlling the magnets substantially as described.

612,644. DEPRESSIBLE RAIL SYSTEM FOR ELECTRICAL RAILWAYS; W. Grunow, Jr., of Bridgeport, Conn. App. filed July 10, 1897. In an electric railway system, contact receptacles, a feeder cable passing into the receptacles, a supporting connection or joint overlapping the end portions of a service conductor provided with means to close the circuit and charge the service conductor.

612,649. BATTERY ELECTRODE; H. S. Lloyd, of Philadelphia, Pa. App. filed Sept. 20, 1897. An electrode, comprising a frame of a practically non-active alloy, and thin parallel strips of metallic lead adapted to become in action the active material, and free from interposed paste, said strips being horizontally supported in said frame, electrically connected therewith and having thickened or reinforced outer edges to lengthen the life of the strips in process of peroxidation.

612,670. ELECTRIC CABLE SWITCH; A. Norman, of Toronto, Can. App. filed April 19, 1897. An electric cable for the propulsion of vehicles, con-



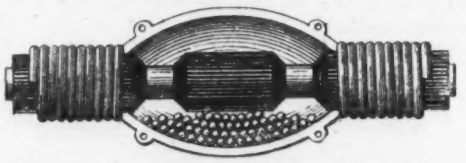
No. 612,426.—Electric Meter.

sisting of a supply conductor surrounded by insulating material, portions of which are removed at predetermined intervals, hollow metallic casings surrounding said insulating material and covering the cutaway portions, a freely flowing conducting material within each of the said casings, and a working conductor surrounding said insulating material and connected to said casings, whereby when the cable is raised a circuit is closed through the supply conductor, the freely flowing conducting material, the casings and the working conductor, substantially as described.

612,681. TELEPHONE EXCHANGE MECHANISM; H. P. Snow, of Erie, Pa. App. filed Nov. 1, 1897. In a telephone exchange mechanism, an office telephone normally out of connection with all of the subscribers' telephones, drop mechanism, comprising means adapted to be operated by the caller's ring and automatically connect such calling telephone with the operator's office telephone, and mechanism connected with said drops adapted when a drop is pushed back to ring up a telephone called for, substantially as described.

612,696. RAIL JOINT FOR ELECTRIC RAILWAYS; M. Barschall, of Berlin, Germany. App. filed March 14, 1898. In an electric railway track, the combination with the rail joint of an auxiliary rail supported by the sleepers and a conductor connecting both jointed track rails and placed in the space between the track rails and the auxiliary rail.

612,708. ELECTRIC SIGNALING APPARATUS; W. E. Decrow, of Boston, Mass. App. filed Dec. 27, 1897. An electric signaling transmitter comprising a train, a box number circuit operating device operated by it to trans-



No. 612,670.—Electric Cable Switch.

mit a box number signal at different speeds at every operation of the train, and an actuating lever for said train, substantially as described.

612,709. ELECTRIC METER OR INDICATOR; W. D. Marks, of Philadelphia, Pa. App. filed Feb. 7, 1898. In an ampere indicator, the combination with the actuating coil or coils of a permanently magnetized movable member and an extra winding or coil on said movable member, substantially as described.